



Environmental Remediation Group

**Olin Corporation**

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**SENT VIA E-mail**

May 10, 2018

Mr. James M. DiLorenzo  
Superfund Project Manager  
United States Environmental Protection Agency (USEPA)  
EPA Region 1 – New England  
5 Post Office Square (OSRR07-4), Boston, MA 02109-3912

**RE: Results of Containment Area Bedrock Borings  
Olin Chemical Superfund Site (OCSS)  
Wilmington, MA**

Dear Mr. DiLorenzo:

Transmitted herewith is a technical memorandum that documents the collection of soil/bedrock cores from within and adjacent to the containment area as well as an evaluation of the collected data from the Olin Chemical Superfund Site, Wilmington, MA.

Should you have any questions related to the information contained herein, please do not hesitate to contact me [at (423) 336-4012] or Chinny Esakkiperumal [at (423) 336-4675].

Sincerely,

A handwritten signature in blue ink, appearing to read 'Jm Cashwell', is written over a light blue horizontal line.

James M. Cashwell  
Director, Environmental Remediation  
Olin Corporation

Enclosure

cc: Garry Waldeck (MassDEP)  
Chinny Esakkiperumal (Olin)  
Michael Murphy (Wood)  
Peter H. Thompson (Wood)

## Technical Memorandum

To: Chinny Esakkiperumal, James Cashwell

From: Peter Thompson, Michael Murphy

Date: May 10, 2018

**Subject: Containment Area Bedrock Boring Results, Olin Chemical Superfund Site (OCSS) in Wilmington MA (Site)**

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This memorandum documents the collection of soil/bedrock cores from within and adjacent to the Containment Area at the Olin Chemical Superfund Site in Wilmington, MA (Site) as well as an evaluation of the results of the collected data.

### Executive Summary

Two bedrock boreholes were installed and evaluated using borehole geophysical methods to verify the nature of the bedrock underlying the Containment Area and the Dense Aqueous Phase Liquid (DAPL) therein at the Site. The boreholes were installed in a manner consistent with Sections 3.1.2 and 3.3 of the USEPA approved Addendum IV – Well Installation Details of the Final RI/FS Work Plan.

One borehole was installed within the Containment Area immediately adjacent to the existing DAPL pool and the other borehole immediately outside of the Containment Area on the north side. The boring inside the Containment Area and immediately adjacent to the associated DAPL pool encountered un-fractured and highly competent bedrock over the entire borehole (to a depth of approximately 180 feet below ground surface (bgs)). The boring outside the area had only one likely water bearing fracture, which was at a depth well below the DAPL (approximately 175 feet bgs). The borings corroborate the previous findings that bedrock underlying the Containment Area is highly competent and no additional investigation is warranted to verify the competency of the bedrock in the vicinity.

### Summary of Work Performed

Two bedrock boreholes were completed from March 19 through March 22, 2018 to collect additional information and to verify the nature of the bedrock underlying the Containment Area and the associated DAPL pool at the Site. The characteristics of interest included bedrock type, style and degree of fracturing which collectively influence the competency and transmissivity of the bedrock. Drilling was conducted under the oversight of a Wood geologist familiar with the Site. These borings were positioned to complement information obtained from the installation of monitoring wells GW-202BR (Figure 1) and BR-1. One boring, OC-BB-2-2018, was positioned along the geologic strike of the competent bedrock lithology encountered in GW-202BR to evaluate lateral geologic continuity of that lithology. The other boring OC-BB-1-2018 was completed perpendicular to geologic strike to evaluate thickness and down dip continuity of that lithology across the other side of the Containment Area. Borings were drilled immediately adjacent to but not through the associated DAPL pool, which resides within a shallow depression in the bedrock surface.

The work was performed in a manner consistent with Sections 3.1.2 and 3.3 of the USEPA-approved Addendum IV – Well Installation Details of the Final RI/FS Work Plan dated April 5, 2010 (MACTEC 2010). Addendum IV Section 3.1.2 specifies the use of air hammer drilling methods where it has been demonstrated that sonic drilling methods are not effective. Previous installation of monitoring well GW-202BRS/D (**Figure 1**) showed that sonic methods

were unable to complete deep bedrock borings at the Containment Area due to the hardness and siliceous nature of the rock matrix and presence of quartz veins. BR-1 was cored using a diamond bit. Therefore OC-BB-1-2018, and OC-BB-2-2018 were drilled by air hammer (air rotary) methods. A smaller, lighter rig was used to facilitate access due to wet ground conditions and to minimize potential for damage to the temporary cover on the Containment Area at location OCSS-BB-2-2018. Overburden was drilled using a hollow stem auger (HSA) and the inner drill casing was installed through the HSA which provided the outer casing. The inner casing was grouted to the top of bedrock and allowed to cure prior to air hammer drilling the bedrock to a completion depth of approximately 150 feet into bedrock at each location. Cuttings and drilling fluids were contained, drummed and managed on-site consistent with Section 3.1.2. Waste characterization samples have been submitted for laboratory analysis and the investigation-derived waste materials will be managed off-site appropriately.

The bedrock borings were completed and secured to allow evaluation of bedrock structure by borehole geophysical methods and identification of water bearing fractures (if any). The boreholes were geophysically logged on March 22 and March 23, 2018, consistent with methods described in Addendum IV paragraphs 4 and 5 of Section 3.3. The boreholes will be abandoned using grout at an appropriate time.

## Bedrock Boring Installation

The following paragraphs describe the installation of each boring. Borehole drilling logs are included in **Attachment 1**.

### OC-BB-1-2018

Drilling activities were started at OC-BB-1-2018 on March 19, 2018. Snow was removed from the drilling location and some brush and small trees were cleared to allow access. Truck mats were placed so the truck mounted CME-75 drill rig would not sink into the snow-covered soils at the drilling location. The overburden was drilled using 6 ¼ inch inside diameter HSAs. The overburden soils were composed primarily of sand with some layers of gravel and cobbles, consistent with other borings that were installed in the past. Bedrock was encountered at 27 feet below ground surface (bgs) and the augers were able to penetrate nearly two feet into weathered bedrock. A six inch air hammer powered by a tow along compressor was then used to clean out the casing and create a socket into competent bedrock. Small potentially water bearing fractures were encountered at approximately 32 and 35.5 feet bgs and a larger fracture was encountered at 40 feet bgs. The rock socket was terminated at 41 feet bgs. Four inch flush jointed steel casing was installed to 41 feet bgs and tremie grouted in place.

The grout was allowed to cure overnight and drilling resumed on March 20<sup>th</sup> using a 4-inch air hammer to clean out the casing and advance the borehole to a target depth of 150 feet into bedrock. The total depth of the borehole was approximately 181 feet bgs. No obvious fractures were encountered and no water was produced from the borehole until about 155 feet bgs when small amount of water started to flow from the borehole and into the drilling tub. From 171 feet to 181 feet bgs an increase in water flow was observed, indicating a potential fracture near the bottom of the borehole. The borehole was allowed to recharge and was surged and air lifted until the water was visually clear. The development water was collected in the drilling tub and ultimately transferred to drums. Five drums of investigation derived waste (IDW) [e.g., drill cuttings, water] were collected and moved to pallets on Site.

### OC-BB-2-2018

Drilling activities were started at OC-BB-2-2018 on March 21, 2018. As shown in **Figure 1**, the drilling location is inside the Containment Area and immediately adjacent to the associated DAPL pool. Truck mats were placed on

top of the snow and Containment Area temporary cap to protect the polyethylene membrane. Similar to OC-BB-1-2018, the overburden was drilled using 6 ¼ inch HSA. The overburden soils were composed of sand with large amounts of gravel and cobbles – however, auger refusal was encountered at approximately 17 feet bgs in what appeared to be cobbles and boulders that included weathered bedrock. The six inch air hammer was then used to clean out the casing and attempt to drill to competent rock. The borehole was quickly advanced, through cobbles, boulders, till, and weathered bedrock, to approximately 27 feet bgs where competent bedrock was encountered. The borehole was advanced to 30 feet bgs. Repeated attempts to clean out the borehole to 30 feet were unsuccessful due to cave in of material and approximately 6 feet of material could not be removed from the bottom of the borehole. The four inch steel casing was hammered to refusal at 28 feet, and grout was tremied into the borehole annulus to attempt to seal off the casing from the overburden. The grout was allowed to set/cure overnight and drilling was resumed on March 22<sup>nd</sup> using the 4" inch air hammer.

The borehole was advanced with the 4-inch air hammer to a target depth of approximately, 150 feet into bedrock. The total borehole depth is approximately 181 feet bgs. The borehole made relatively low quantities of water from the very first run – the water recovery was associated with potential seepage around the casing. The casing as installed was adequate to recover drill cutting and drilling continued. The drill water was contained and collected in the drilling tub and transferred to 55 gallon drums. A total of 18 drums of IDWs were collected and moved to pallets in the previously identified drum storage area. Note, during drilling, possible fractures were noted by the driller and field geologist at 43 feet, 58 feet, and 115 feet bgs based on the drill rod advancement. However, such fractures were not confirmed by subsequent geophysical logging. The drill rod advancement could be due to variety of reasons (e.g., minor changes in rock mineral content; slight difference in fracture orientation; etc.)

## Borehole Geophysical Logging

Borehole geophysical logging of the completed 4" open hole bedrock borings was completed on March 22<sup>nd</sup> (OC-BB-1-2018) and March 23<sup>rd</sup> (OC-BB-2-2018). Borehole geophysical logging consisted of caliper, temperature, natural gamma, resistance, spontaneous potential, fluid conductivity, and heat pulse flow meter measurements under ambient and pumping conditions. In addition, acoustic televiewer (ATV) and optical televiewer (OTV) logging were performed and images were generated for each borehole. Borehole geophysical logs are included in **Attachment 2**. A summary and discussion of geophysical logs for the two boreholes are provided below.

### OC-BB-1-2018

The borehole geophysical results at OC-BB-1-2018 indicated a water bearing (likely transmissive) fracture at approximately 175 feet bgs. This is supported by a large caliper deviation, an ATV amplitude signature and a visual indication of a fracture on the OTV log in addition to positive identification in the heat pulse flow meter (HPFM) testing and inflections in the temperature, fluid conductivity, spontaneous potential and resistance logs. HPFM data suggests a possible (very) small increase to borehole flow at 115-118 feet and 105 feet bgs (possible transmissive zones) associated with small caliper deviations, a small resistance inflection at 118 feet and a gradual change in fluid conductivity at 105 feet. The presence of transmissive fracture at these intervals is not well corroborated by the ATV and OTV logs or other logs. Overall these features indicate the potential presence of weakly transmissive fracture(s). Small pumping rate variations can occur during testing due to fluctuations in the rotational speed of the whale pump and small variations of 0.01-0.02 gpm may or may not be meaningful.

Fractures in OC-BB-1-2018, to the extent they are present, parallel bedding striking northeast, with steep dips to the northwest of 60 to 80 degrees.

Overall, the bedrock is competent and the observed fractures are well below the bottom of the DAPL in the Containment Area (**Cross Section A-A'**).

## OC-BB-2-2018

The borehole geophysical results at OC-BB-2-2018 confirmed 150 feet of competent bedrock below minor seepage encountered at the bottom of the casing. The OTV log clearly shows the separation between the steel casing and the bedrock surface within the bedrock socket. Although the composite log correctly identifies this as a “likely transmissive zone”, it is not a fracture. The borehole logging identified only one potential “possible transmissive zone” related to fracturing and that is based solely on a caliper deviation at 140 feet bgs. There are no inflections in any other logs at this depth, no flow was measured with the HPFM from depths below 35 feet, and there were no obvious fractures present in the ATV amplitude log or the OTV log. The two borehole features at 140 feet bgs depth dip to the northwest and north-northeast at approximately 60 degrees. It is unlikely that this zone represents a transmissive fracture interval. In general it appears that bedrock in OC-BB-2-2018 is un-fractured and highly competent over the entire borehole.

Similar to OC-BB-1-2018, bedrock is competent in the vicinity and the observed fractures are well below the bottom of the DAPL in the Containment Area (**Cross Section B-B'**)

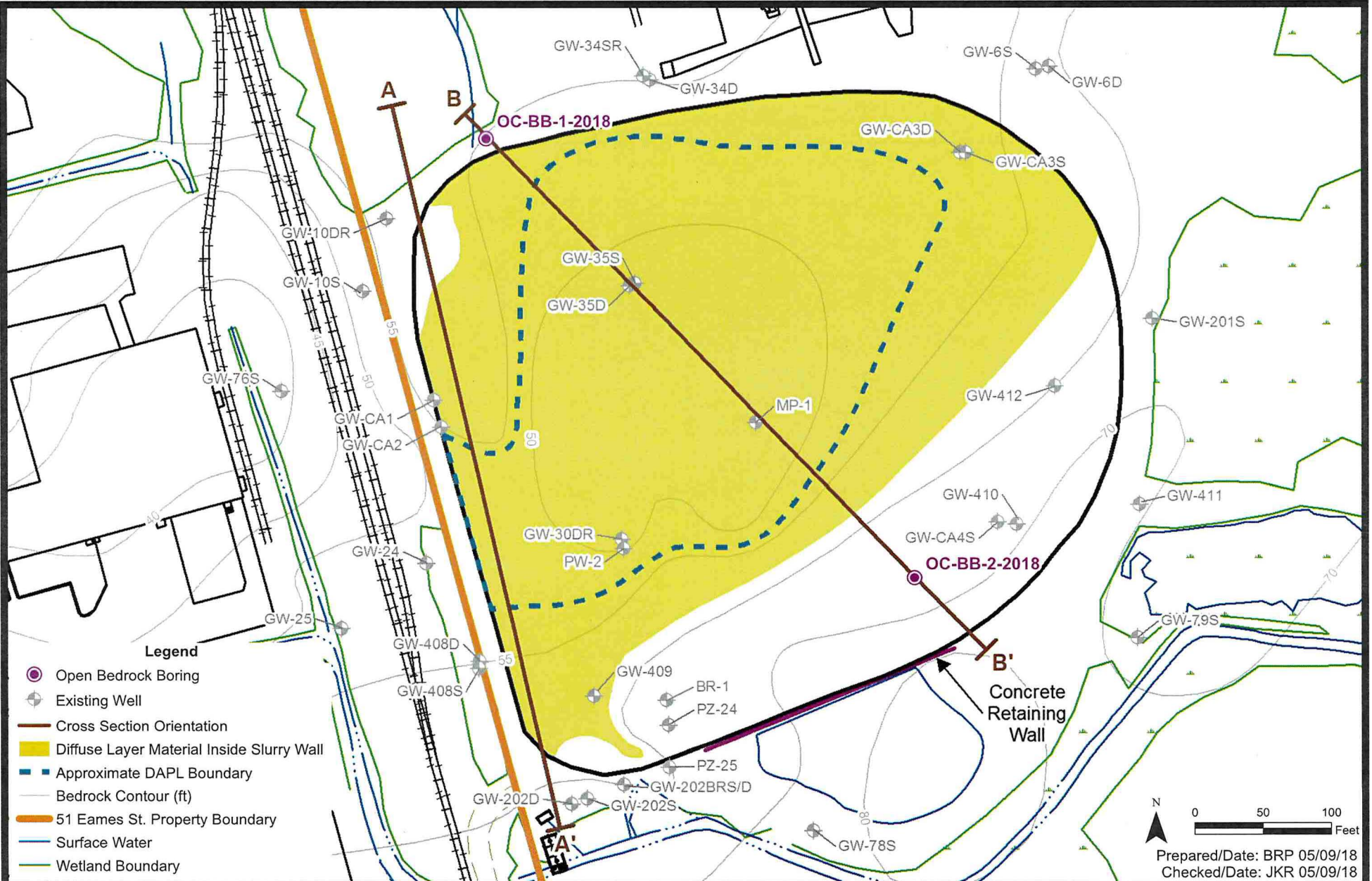
## Conclusions with Respect to Containment Area Conceptual Site Model

The two bedrock boreholes were completed along and across geologic strike of the siliceous competent bedrock (mapped as a quartzite) and drilled previously in GW-202BR and BR-1. The rock comprises a light to dark grey fine grain quartz rich matrix with abundant veins of white quartz parallel to foliation. OC-BB-2-2018 drilling and borehole geophysical logging supports a conclusion that the quartz rich lithology is laterally continuous along the south side of the on-Property DAPL pool. OC-BB-1-2018 drilling and borehole geophysical logging indicates that the thickness of this lithology extends to the far side of the DAPL pool within the Containment Area and is therefore expected to underlie the DAPL pool. Based on drilling observation (primarily penetration rates), there may be zones in the lithology intercepted by OC-BB-1-2018 that are not as siliceous indicating the lithology mineral composition is changing gradually in stratigraphically higher sections (to the northwest); however those zones with less quartz were also not fractured. Only one likely water bearing fracture was identified (175 feet in OC-BB-1-2018) in the three deepest boreholes to date (including GW-202BR) which total approximately 450 liner feet of bedrock drilling around the Containment Area. However, the potential water-bearing fracture appears to be at depths well below the bottom of the DAPL and is not in contact with the DAPL. This region of bedrock is clearly sparsely fractured (*de minimis*) and competent compared to other bedrock boreholes drilled to date.

The orientation of fracture features is predominantly parallel to relict bedding (foliation) of the bedrock which strikes north easterly and dips moderately to steeply (50-80 degrees) toward the northwest. The direction of groundwater flow is from the northwest to the southeast, perpendicular to the orientation of bedrock foliation underlying the Containment Area. Fractures parallel to this groundwater flow direction do exist but are sparse and not generally correlated with identified transmissive zones. Therefore, the transmissivity across bedrock underlying the Containment Area in the direction of groundwater flow is expected to be extremely low and the fracture network, to the extent it exists, is not well connected.

The recently installed borings corroborate the previous findings from GW-202BR and BR-1 that bedrock underlying the Containment Area is competent and no additional investigation is warranted to verify the competency of the bedrock in the vicinity.

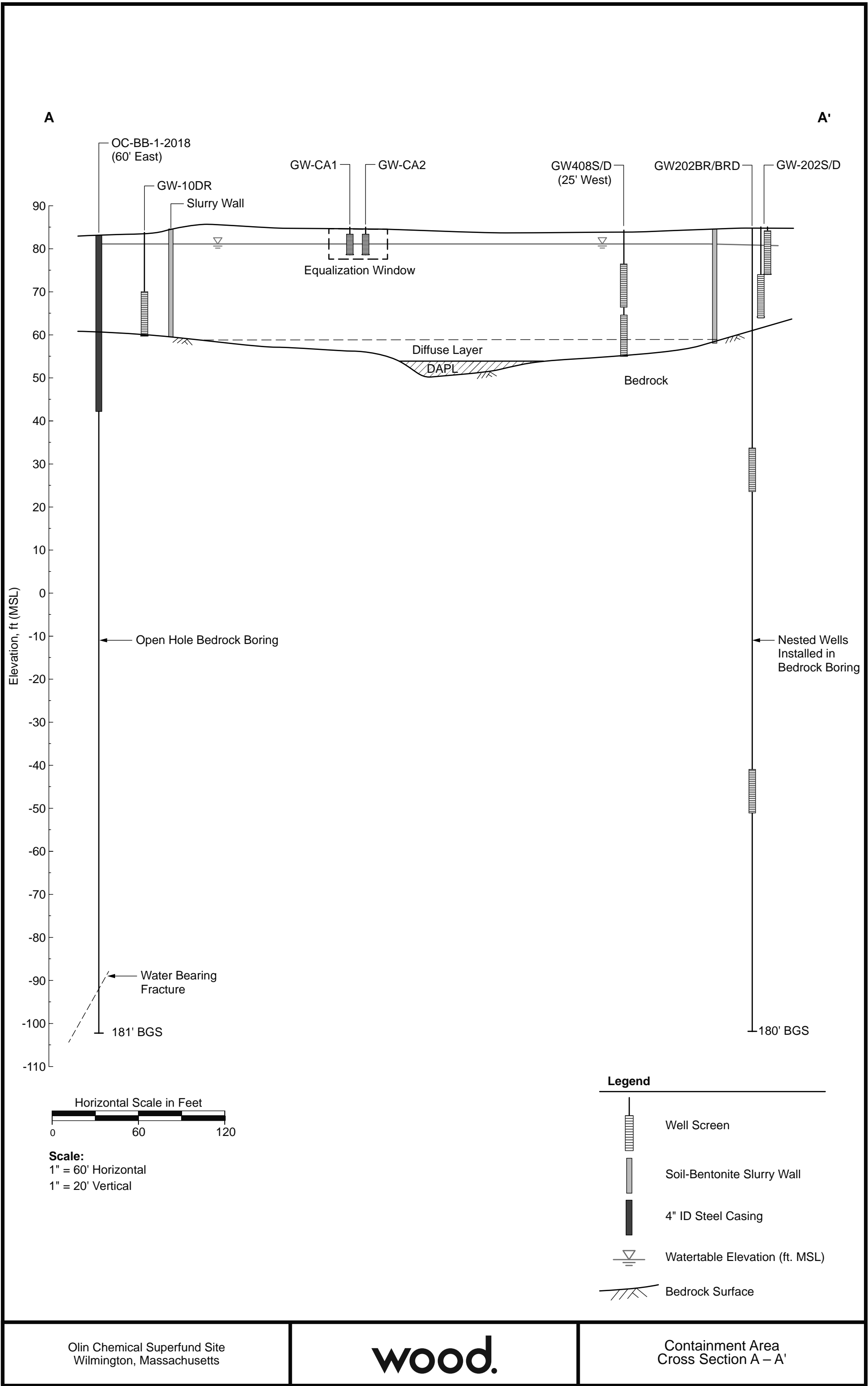
## Figures

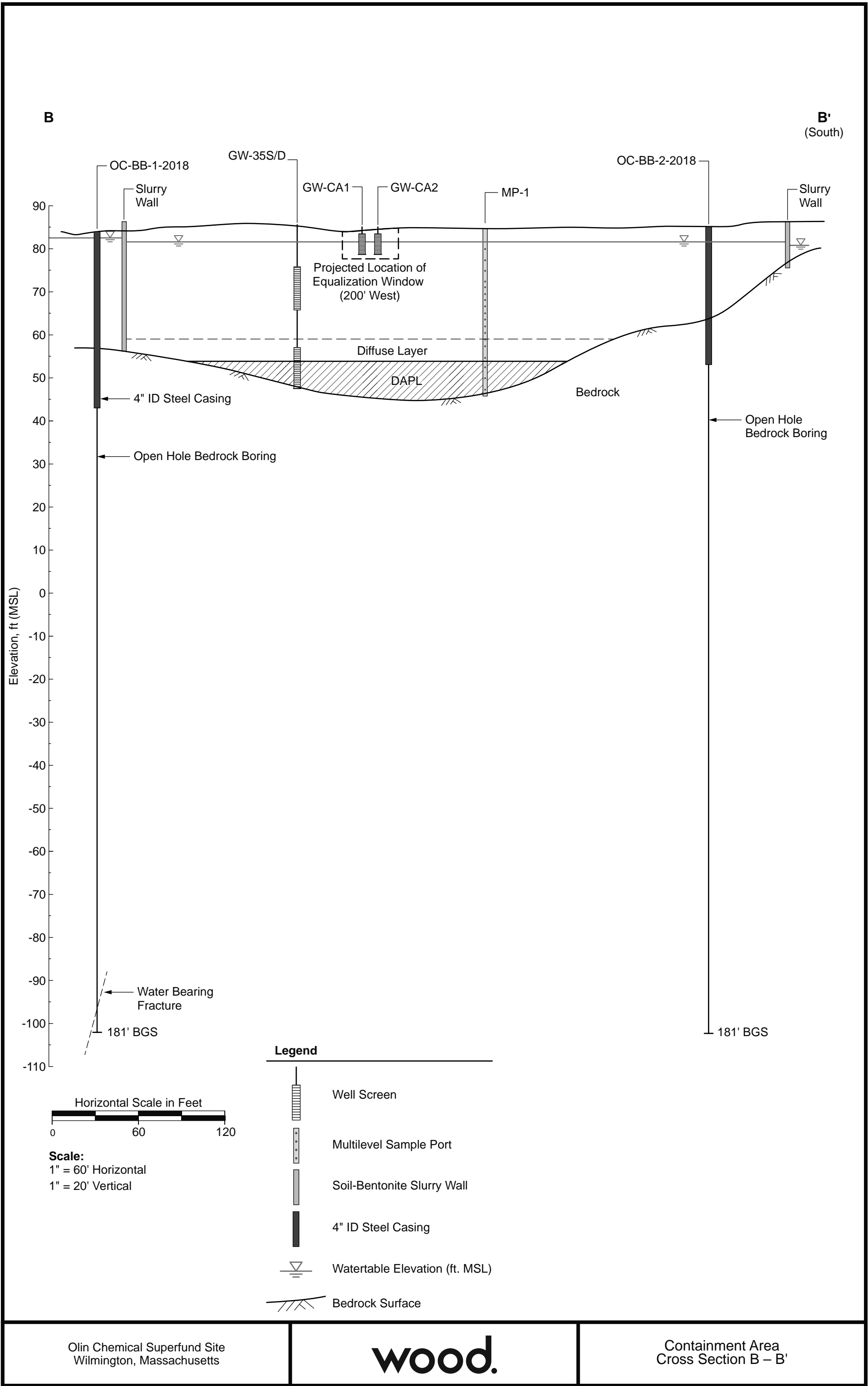


Olin Chemical Superfund Site  
Wilmington, Massachusetts

**wood.**

Figure 1  
Location of Borings and Cross Sections  
Containment Area





**Attachment 1**

**Boring Logs**

BORING NO.: OC-BB-1-2018

wood.

PROJECT NAME: Olin - Wilmington, MA	DRILLING CO.: GeoSearch	SHEET: 1 OF 3
PROJECT NUMBER: 6107180016	DRILLER: Shawn Preston	DRILLING METHOD: 6 ¼-in. HSA: 6-in. AirH: 4-in. AirH
LOCATION: Containment Area (outside cap)	DATE STARTED: 3/19/18	DRILL RIG MODEL: CME-75
BOREHOLE DEPTH: 181 ft. BGS	DATE FINISHED: 3/20/18	SAMPLER SIZE & TYPE: N/A
BOREHOLE DIAMETER: 4-in. (open-hole)	GEOLOGIST: Jerry Rawcliffe	HAMMER WEIGHT: N/A
REMARKS: HSA = Hollow Stem Auger, AirH = Air Hammer		HAMMER DROP: N/A
		HAMMER TYPE: N/A

Sample #	Sample Depth	Blow Counts	Rec. (ft./ft.)	Description	Well Diagram	Headspace (ppmv)	Lab Sample
--	--	N/A	N/A	<p>Logged auger cuttings:</p> <p>0-0.8 ft. Dark brown to very dark brown organics with some fine to medium sand and a little coarse sand.</p> <p>0.8-3.5 ft. Yellow brown fine to medium sand very moist. Soils saturated by 3 ft. below ground surface (BGS).</p> <p>3.5 ft. Encountering gravel and cobbles.</p> <p>3.5-12 ft. Yellow brown to light olive brown fine to coarse sand with some gravel. Wet, micaceous.</p> <p>12-17 ft. Yellow brown to light olive brown fine to coarse sand with a little gravel, Wet.</p> <p>17-18.5 ft. Gravelly layer.</p> <p>18.5-25 ft. Yellow brown to brown fine to medium sand with a little coarse sand and a little gravel.</p>		0.0	N/A
	29 ft.			<p>Encountered bedrock at 27 ft. BGS.</p> <p>Augered to 29 ft. through weathered bedrock.</p>		0.0	
	30 ft.					0.0	
	32 ft.			Fracture at ~ 32 ft. BGS (some water)			
	34 ft.						
	36 ft.			Fracture at ~ 35.5 ft. BGS (some water)			
	38 ft.						
	40 ft.			<p>Fracture at ~ 40-40.5 ft. BGS - Increase in water.</p> <p>Grout steel casing in borehole ~41 ft. BGS</p>			

BORING NO.: OC-BB-1-2018

wood.

PROJECT NAME: Olin - Wilmington, MA	DRILLING CO.: GeoSearch	SHEET: 2 OF 3
PROJECT NUMBER: 6107180016	DRILLER: Shawn Preston	DRILLING METHOD: 6 ¼-in. HAS: 6-in. AirH: 4-in. AirH
LOCATION: Containment Area (outside cap)	DATE STARTED: 3/19/18	DRILL RIG MODEL: CME-75
BOREHOLE DEPTH: 181 ft. BGS	DATE FINISHED: 3/20/18	SAMPLER SIZE & TYPE: N/A
BOREHOLE DIAMETER: 4-in. (open-hole)	GEOLOGIST: Jerry Rawcliffe	HAMMER WEIGHT: N/A
REMARKS: BKG = background		HAMMER DROP: N/A
		HAMMER TYPE: N/A

Sample #	Sample Depth	Blow Counts	Time	Description	Well Diagram	Headspace (ppmv)	Lab Sample
	N/A	N/A		Set casing (4-inch ID steel flush joint.) to approximately 41 ft. BGS and tremie grouted with Portland Type II cement. Logging Air Hammer rock chips at ~ 5 ft. intervals.	Open Hole		N/A
	40 ft.		8:40	Cuttings are small, medium to coarse sand coarse sand sized rock chips.			
			8:46	41-50 ft. Very dark gray to black color.			
				No observed fractures - borehole dry.			
	50 ft.		9:00	50-67 ft. Dark gray to very dark gray cuttings with some white (quartz) fragments.			
			9:10			0.2	
	60 ft.		9:21				
			9:30	Possible fracture at 67 ft. BGS (based on air hammer).			
				67-90 ft. Dark gray cuttings with little quartz (white) fragments.			
				No observed fractures. Borehole dry.			
	70 ft.		9:40				
			9:48				
	80 ft.		9:57				
			10:04				
	90 ft.		10:12	90-101 ft. Very dark gray to dark gray trace quartz and some green colored chips.			
				No observed fractures or water.			
			10:19				
	100 ft.		10:40	101-112 ft. Very dark gray trace quartz.			
				No observed fractures, no water from borehole.			
			10:46			0.8 (BKG)	
	110 ft.		10:55	112-130 ft. Dark gray chips trace quartz, amount varies slightly. No observed fractures, no water from borehole.			
			11:01				
	120 ft.		11:11				
			11:18				

BORING NO.: **OC-BB-1-2018**

**wood.**

PROJECT NAME: Olin - Wilmington, MA	DRILLING CO.: GeoSearch	SHEET: 3 OF 3
PROJECT NUMBER: 6107180016	DRILLER: Shawn Preston	DRILLING METHOD: 6 ¼-in. HAS: 6-in. AirH: 4-in. AirH
LOCATION: Containment Area (outside cap)	DATE STARTED: 3/19/18	DRILL RIG MODEL: CME-75
BOREHOLE DEPTH: 181 ft. BGS	DATE FINISHED: 3/20/18	SAMPLER SIZE & TYPE: N/A
BOREHOLE DIAMETER: 4-in. (open-hole)	GEOLOGIST: Jerry Rawcliffe	HAMMER WEIGHT: N/A
REMARKS:		HAMMER DROP: N/A
		HAMMER TYPE: N/A

[illegible]

PROJECT NAME: Olin - Wilmington, MA	DRILLING CO.: GeoSearch	SHEET: 1 OF 3
PROJECT NUMBER: 6107180016	DRILLER: Shawn Preston	DRILLING METHOD: 6 ¼-in. HSA: 6-in. AirH: 4-in. AirH
LOCATION: Containment Area (inside cap)	DATE STARTED: 3/21/18	DRILL RIG MODEL: CME-75
BOREHOLE DEPTH: 181 ft. BGS	DATE FINISHED: 3/22/18	SAMPLER SIZE & TYPE: N/A
BOREHOLE DIAMETER: 4-in. (open-hole)	GEOLOGIST: Jerry Rawcliffe/ Chris Mazzolini	HAMMER WEIGHT: N/A
REMARKS: 6 x Soil/Bedrock Drums - IDW	HSA = Hollow Stem Auger, AirH = Air Hammer	HAMMER DROP: N/A
18 x Water Drums - IDW	BKG = background	HAMMER TYPE: N/A

Date	Sample Depth	Blow Counts	Time	Description	Well Diagram	Headspace (ppmv)	Lab Sample
3/21/2018	--	N/A	8:30	Logged auger cuttings:			N/A
	0.0-3 ft.			Fine to medium brown sand		0.0	
	3 ft.			Cobbles and gravel		0.0	0.2 (BKG)
	5 ft.			Very dark brown fine to coarse sand and silt mixed with organics, gravel, and cobbles.		0.0	
	10.5 ft.			Cobbles/ rubble or weathered rock.		0.0	
	15 ft.			Cobble material/ weathered rock.		0.1	
	16.5-17 ft.			Hit Bedrock. (possible boulders/cobbles)			
	17-21 ft.		9:00	Auger to 17.5 ft. (Refusal with augers)			
	27 ft.		10:00	Air hammer (fractured rock/boulders/weathered rock) need to set casing deeper.			
				Air hammer to 27 ft. Hit competent rock at 27 ft.			
	30 ft.		11:30	Air hammer 3 ft. into competent rock.			
	28 ft.		12:00	At 30 ft. had 6 ft. of cave-in. Tried to clean hole.			
				Set steel casing (6-in.) to approximately 28 ft. BGS			
				Grout casing in borehole ~28 ft.			
				Grouted in place with Portland Type II cement.			
3/22/2018				Log Air Hammer rock chips at ~ 10 ft. intervals.			
	28-35 ft.		9:10	Cleaned out casing with 4" air hammer then reset casing to approximately 30 feet bgs and resumed drilling with 4" air hammer.		0.2	
				Drive 4-in. Air Hammer slowly. Dark gray medium to coarse size rock chips.		0.2 (BKG)	
				Seal appears to be holding (Geosearch), no fractures observed and borehole making water. (Possible seepage at toe of casing).			
	35-40 ft.		9:30	35-55 ft. Dark gray to black medium to coarse chips. Trace quartz (white).		0.1	
	40-45 ft.		9:45	No fractures observed, borehole making water.		0.2	
				Possible fracture at 43 ft. BGS (based on air hammer).			
	45-50 ft.		9:50	Dark gray to very dark gray medium to coarse chips, trace quartz.		0.2	
				No fractures observed, borehole making water.			
	50-55 ft.		10:05	No fractures observed, borehole making water.		0.3	

PROJECT NAME: Olin - Wilmington, MA	DRILLING CO.: GeoSearch	SHEET: 2 OF 3
PROJECT NUMBER: 6107180016	DRILLER: Shawn Preston	DRILLING METHOD: 6 ¼-in. HSA: 6-in. AirH: 4-in. AirH
LOCATION: Containment Area (inside cap)	DATE STARTED: 3/21/18	DRILL RIG MODEL: CME-75
BOREHOLE DEPTH: 181 ft. BGS	DATE FINISHED: 3/22/18	SAMPLER SIZE & TYPE: N/A
BOREHOLE DIAMETER: 4-in. (open-hole)	GEOLOGIST: Chris Mazzolini	HAMMER WEIGHT: N/A
REMARKS: BGS = below ground surface BKG = background	HAMMER DROP: N/A	HAMMER TYPE: N/A

Sample #	Sample Depth	Blow Counts	Time	Description	Well Diagram	Headspace (ppmv)	Lab Sample
N/A	55-65 ft.	N/A	10:10	Dark gray with medium to coarse rock chips with quartz (white) and feldspar (peach) chips observed. Possible fracture (based on air hammer) ~ 58 ft. BGS. Borehole making water.	Open Hole	0.2	N/A
	65-75 ft.		10:20	65-85 ft. Dark gray with medium to coarse rock chips with quartz (white), trace feldspar (peach) chips observed. No observed fractures, borehole making water.		0.1	
	75-85 ft.		10:40	No observed fractures, borehole making water.		0.3	0.4 (BKG)
	85-95 ft.		11:00	Dark gray medium to coarse chips with more quartz and feldspar observed. No fractures observed, borehole making water 1 gpm (GeoSearch).		0.2	
	95-105 ft.		11:30	Dark gray with some olive green medium to coarse chips, trace feldspar (peach) and quartz (white) observed. No fractures observed, borehole making water.		0.2	
	105-115 ft.		11:45	105-125 ft. Dark gray with some olive green medium to coarse chips and quartz. Possible fracture (based on air hammer) ~ 115 ft. Borehole making water.		0.1	0.4 (BKG)
	115-125 ft.		12:10	No observed fractures, borehole making water.		0.2	
	125-135 ft.		12:20	Dark gray with olive green medium to coarse chips with trace quartz. No observed fractures, borehole making water.		0.2	

BORING NO.: OC-BB-2-2018

wood.

PROJECT NAME: Olin - Wilmington, MA	DRILLING CO.: GeoSearch	SHEET: 3 OF 3
PROJECT NUMBER: 6107180016	DRILLER: Shawn Preston	DRILLING METHOD: 6 ¼-in. HSA: 6-in. AirH: 4-in. AirH
LOCATION: Containment Area (inside cap)	DATE STARTED: 3/21/18	DRILL RIG MODEL: CME-75
BOREHOLE DEPTH: 181 ft. BGS	DATE FINISHED: 3/22/18	SAMPLER SIZE & TYPE: N/A
BOREHOLE DIAMETER: 4-in. (open-hole)	GEOLOGIST: Chris Mazzolini	HAMMER WEIGHT: N/A
REMARKS: HSA = Hollow Stem Auger, AirH = Air Hammer	HAMMER DROP: N/A	HAMMER TYPE: N/A

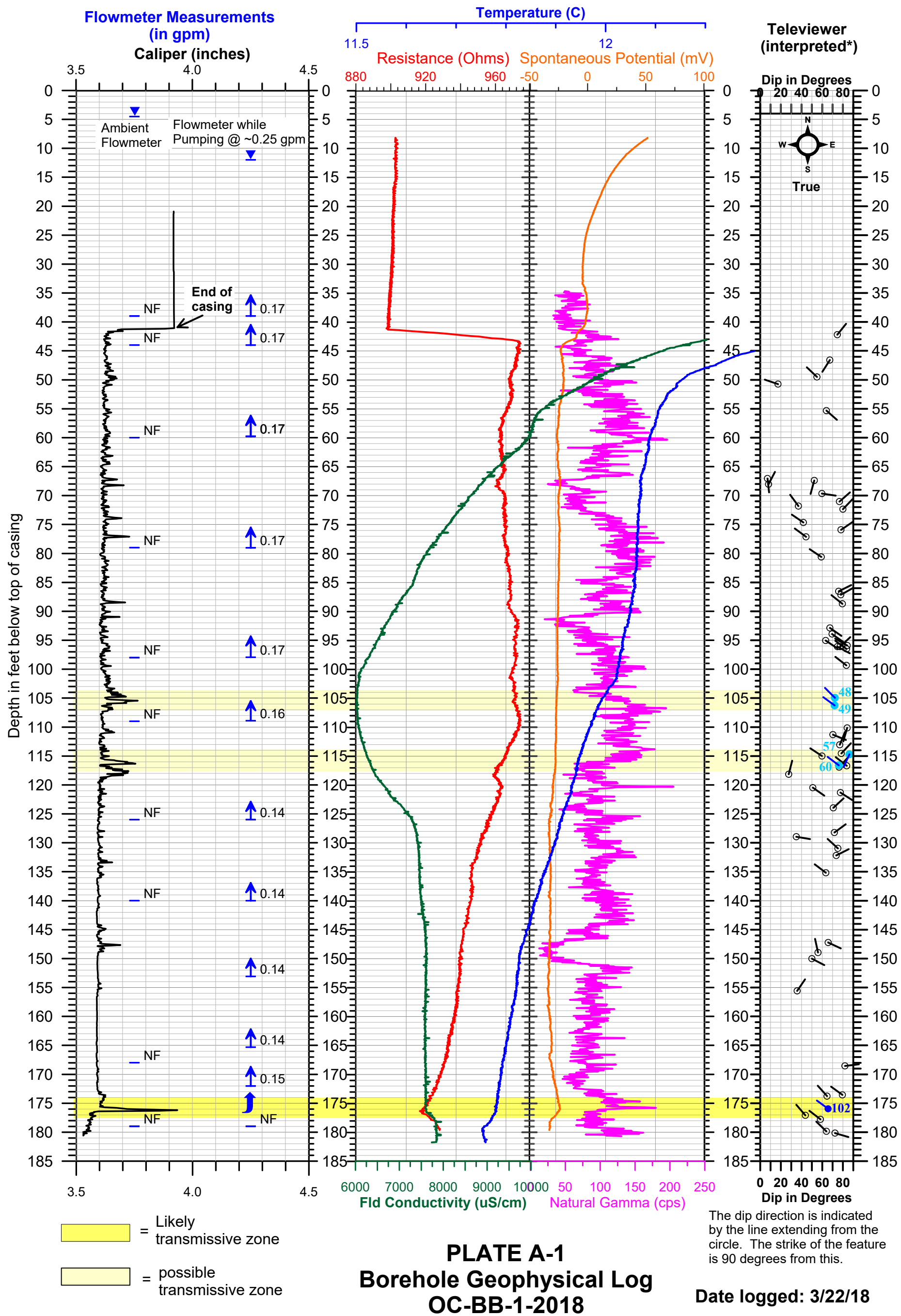
Sample #	Sample Depth	Blow Counts	Time	Description	Well Diagram	Headspace (ppmv)	Lab Sample
N/A	135-145 ft.	N/A	12:40	135-155 ft. Very dark gray to gray with medium to coarse rock chips with little quartz. No observed fractures, borehole making water.	Open Hole	0.2	
	145-155 ft.		13:00	No observed fractures, borehole making water.		0.3	
	155-165 ft.		13:15	155-175 ft. Very dark gray to gray medium to coarse rock chips with olive green chips and quartz. No observed fractures, borehole making water.		0.2	0.4 (BKG)
	165-175 ft.		13:40	No observed fractures, borehole making water.		0.3	
	175-181 ft.		14:00	Dark gray to gray medium to coarse rock chips with little quartz. No observed fractures, borehole making water. 181 ft. Bottom of Borehole.		0.2	
				DTW: 4.05 ft. Top of casing (TOC) DTB: 182.9 ft. (TOC)			

**Attachment 2**  
**Borehole Geophysical Logs**

**ATTACHMENT 2A**  
**BOREHOLE GEOPHYSICAL LOGS**  
**OC-BB-1-2018**

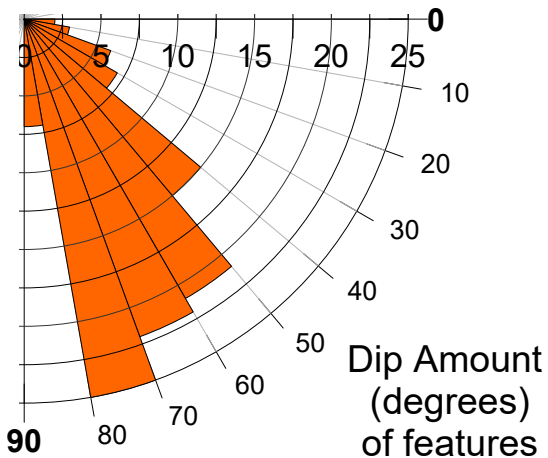
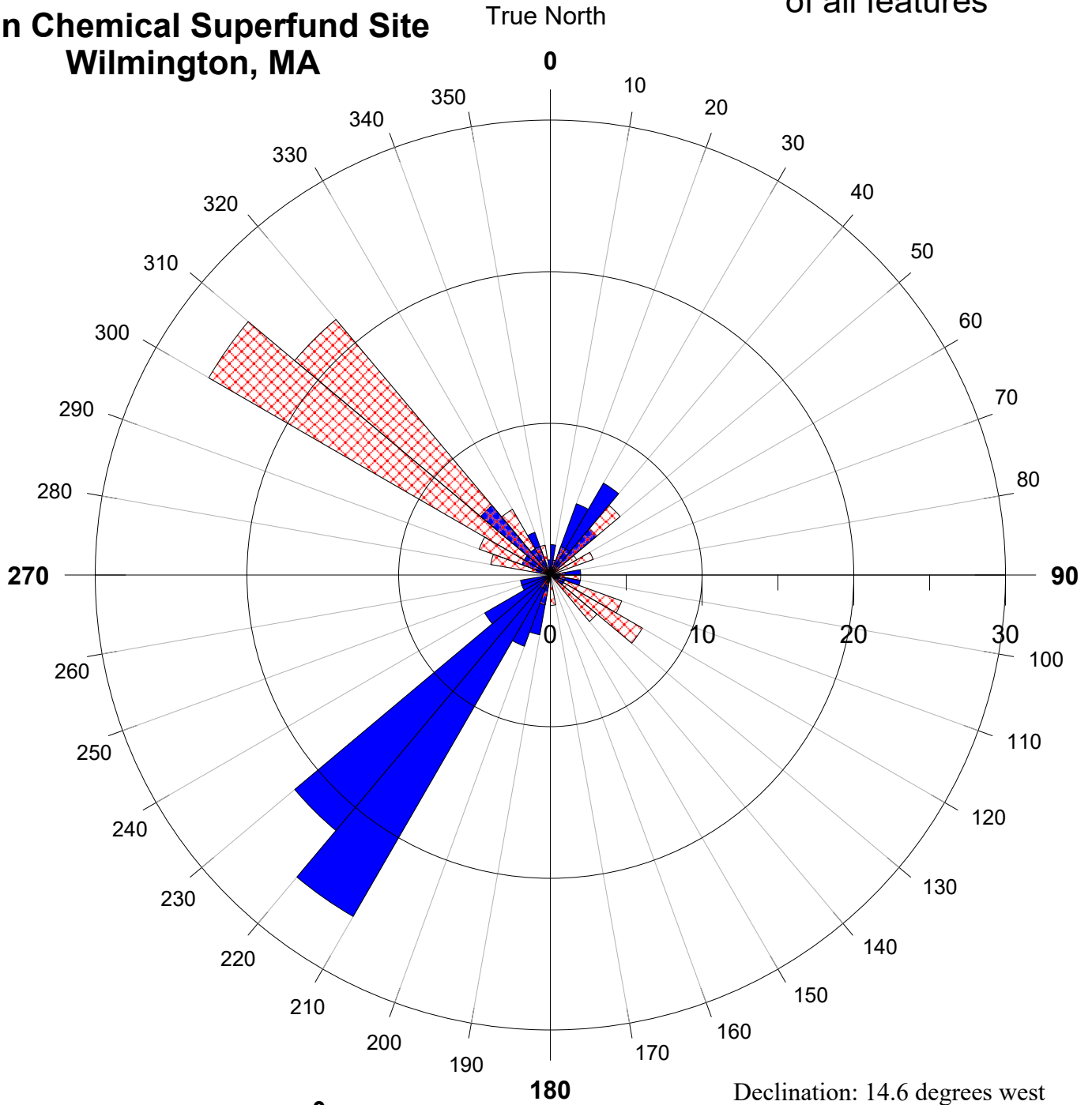
PLATE A-1  
Borehole Geophysical Log  
OC-BB-1-2018  
Olin Site  
Wilmington, MA.

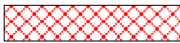


Date logged: 3/22/18



**OC-BB-1-2018**  
**Olin Chemical Superfund Site**  
**Wilmington, MA**

**PLATE A-2**  
**Strike and Dip Direction**  
**of all features**

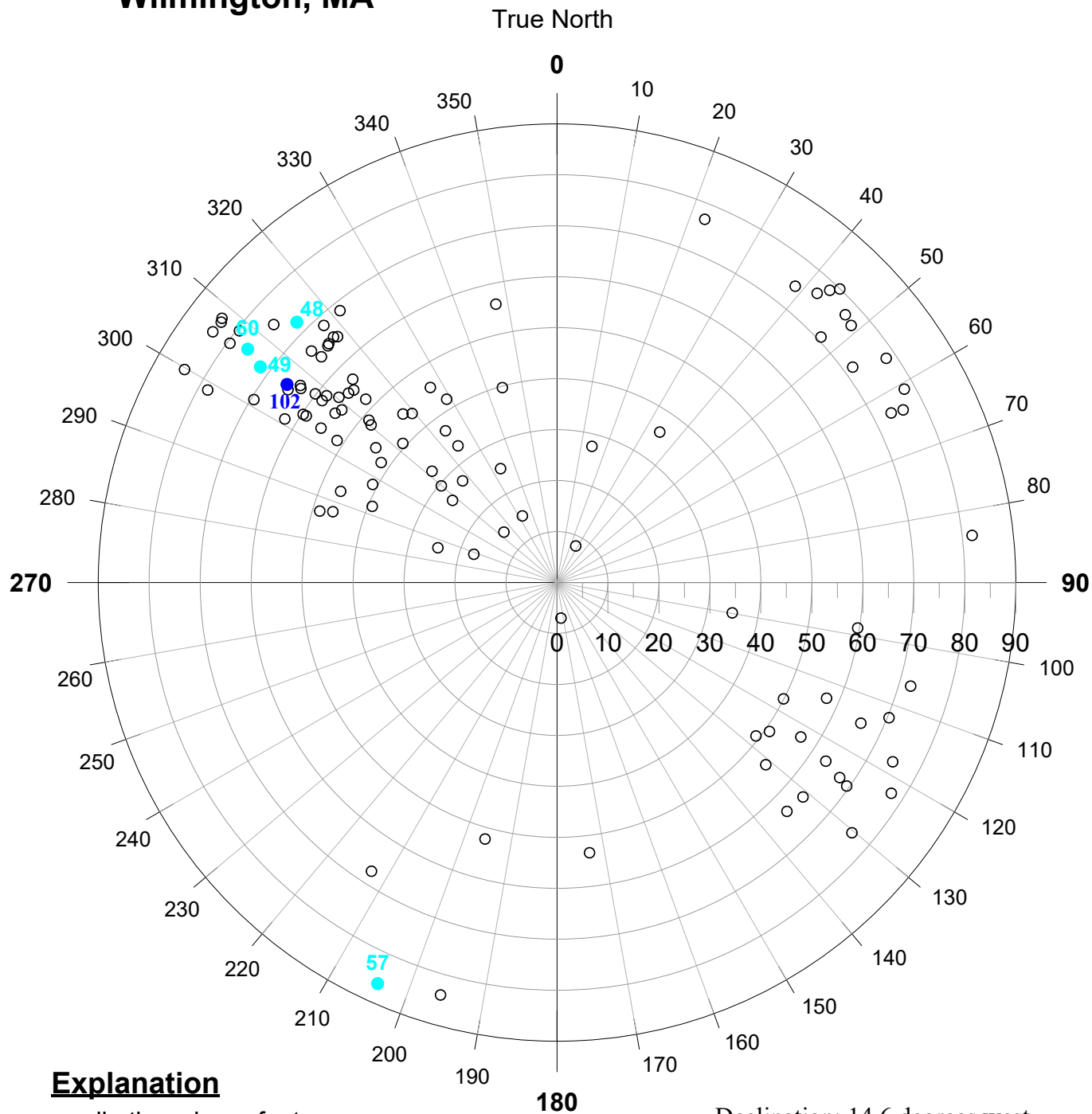


- Explanation
-  Dip direction of feature
  -  Strike of feature
  -  Dip Amount (Tilt)

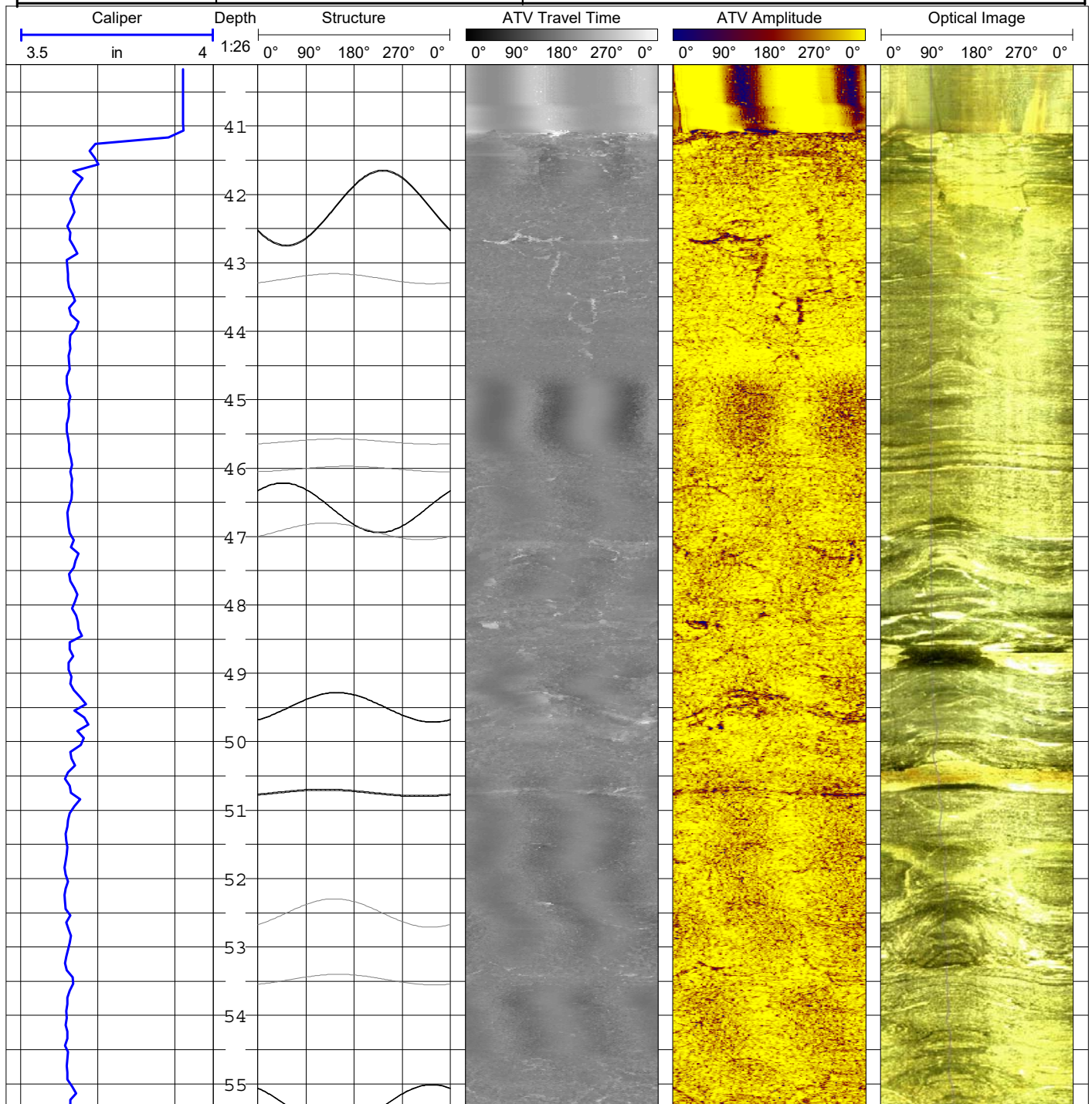
Based on 108 measurements

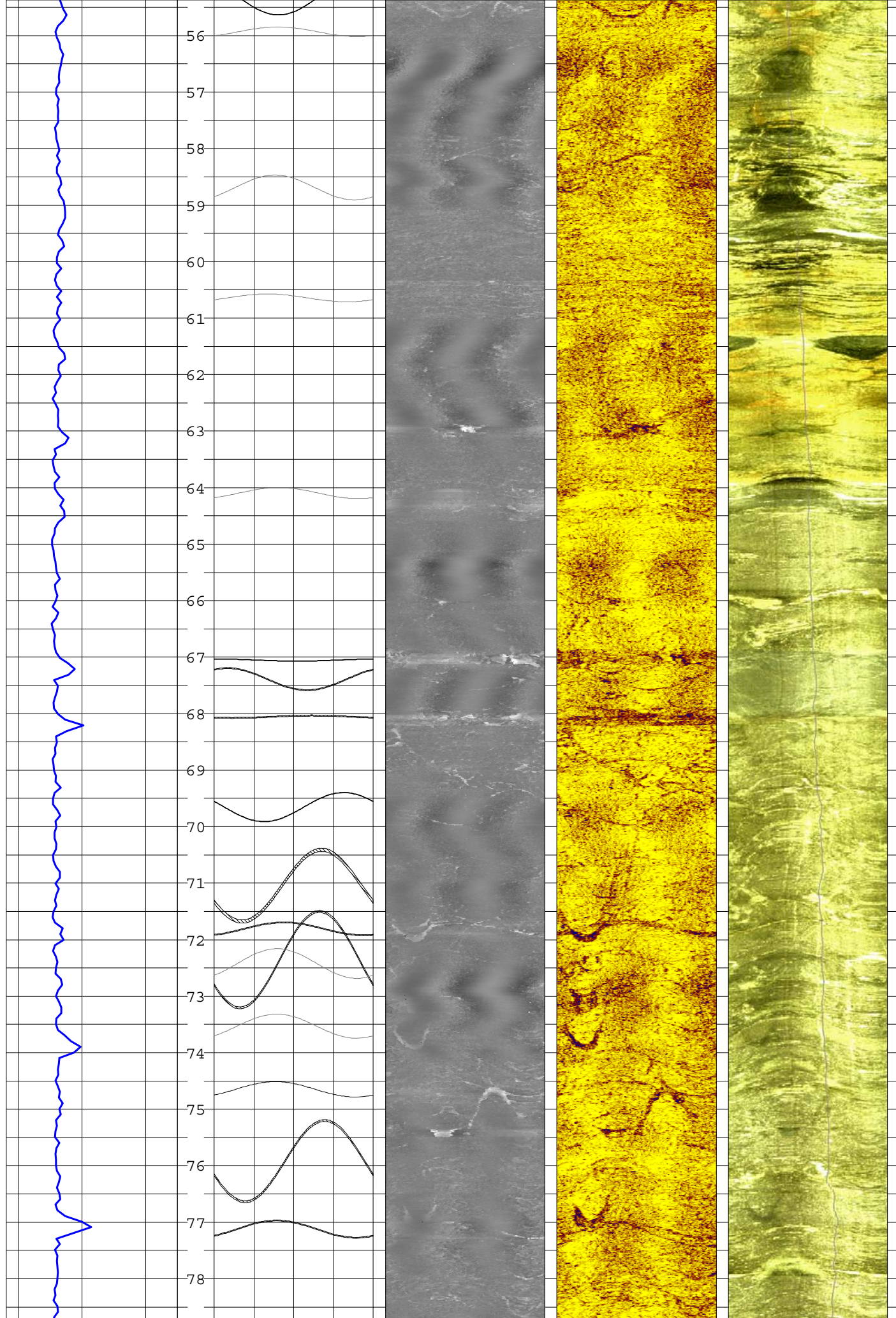
**OC-BB-1-2018**  
**Olin Chemical Superfund Site**  
**Wilmington, MA**

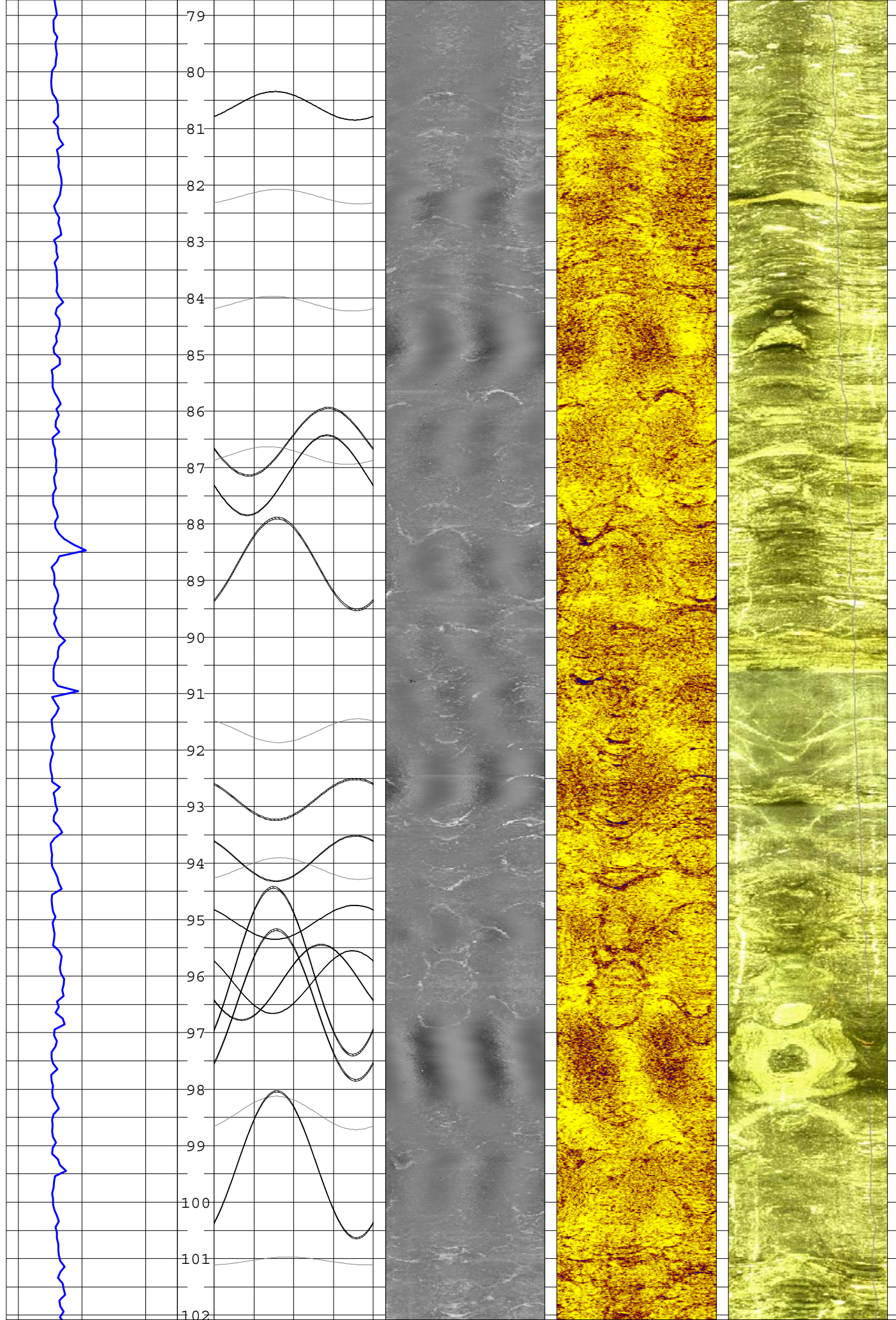
**PLATE A-3**  
**Dip Amount and Dip Azimuth**  
**of planar features**  
**(upper hemisphere plot)**

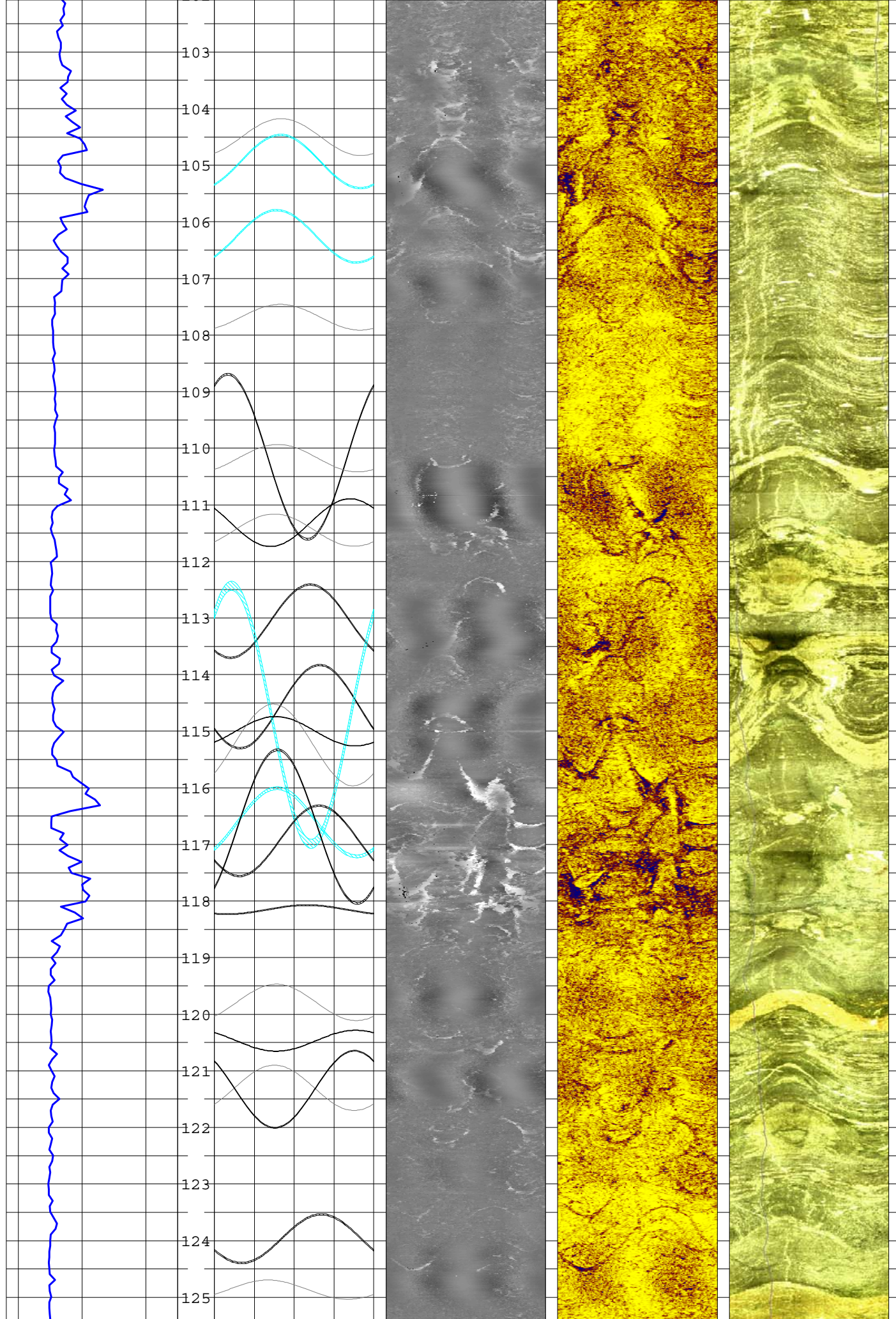


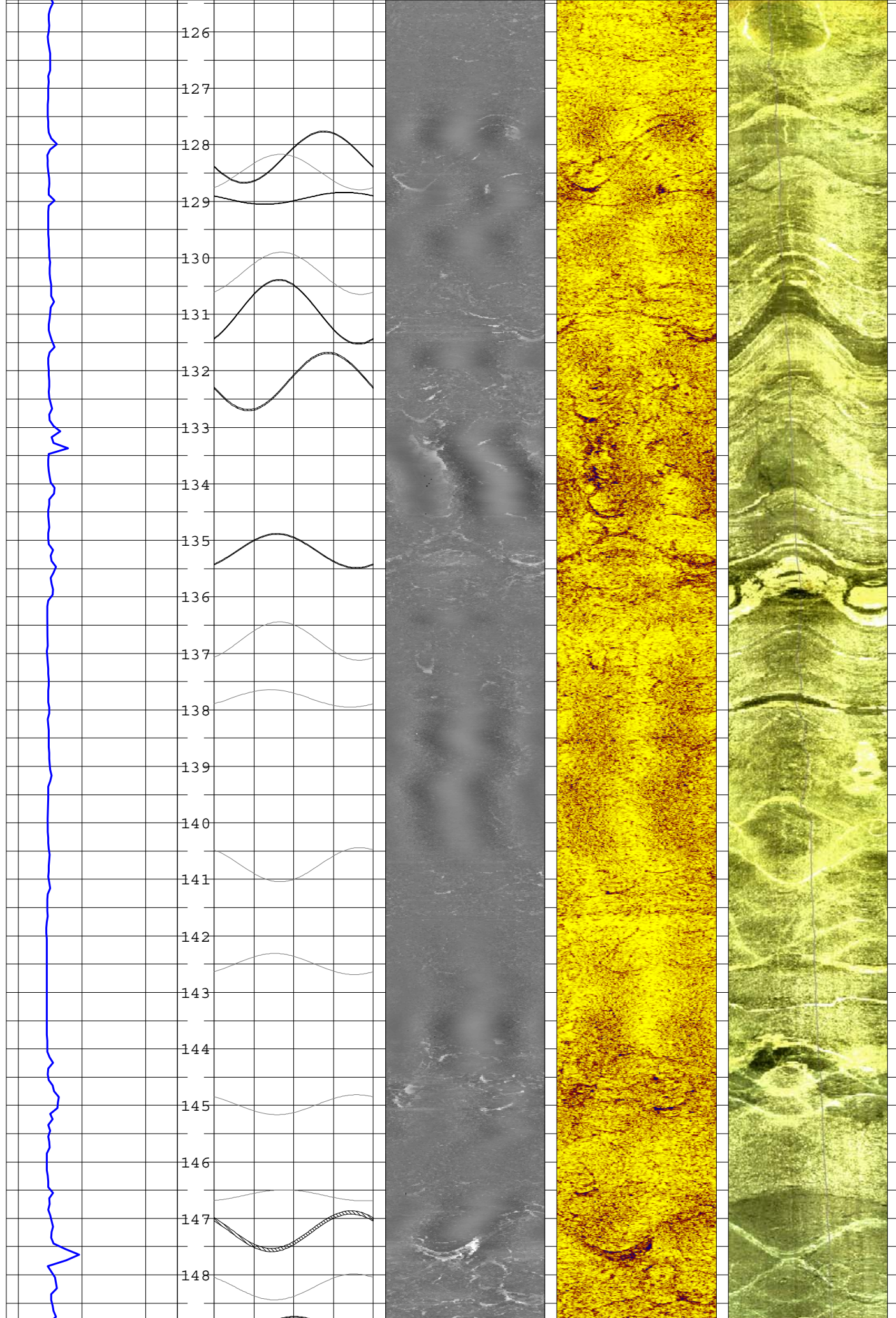
<b>Northeast Geophysical Services</b> 4 Union Street Bangor, Maine 04401 Tel. 207-942-2700 email: ngsinc@negeophysical.com		<b>Log: Plate A-4 Televiwer &amp; Caliper Logs</b>	
		Well: OC-BB-1-2018	
		Site: Olin	
Date:	3/22/2018	Location: Wilmington, MA	
Casing Depth:	41.0 ft.	For:	Wood
Casing Type:	steel	Logged by:	R. Rawcliffe
Boring Depth:	181.7 ft	Orientation:	magnetic
Meas. From:	top of casing	<b>Structure Plots:</b> black = planar features (faults, foliation, bedding, joints, etc) light blue = possibly transmissive fracture dark blue = likely transmissive fracture	
<b>Stickup:</b>	0.45 ft.		
<b>Water Level:</b>	4.55 ft.		

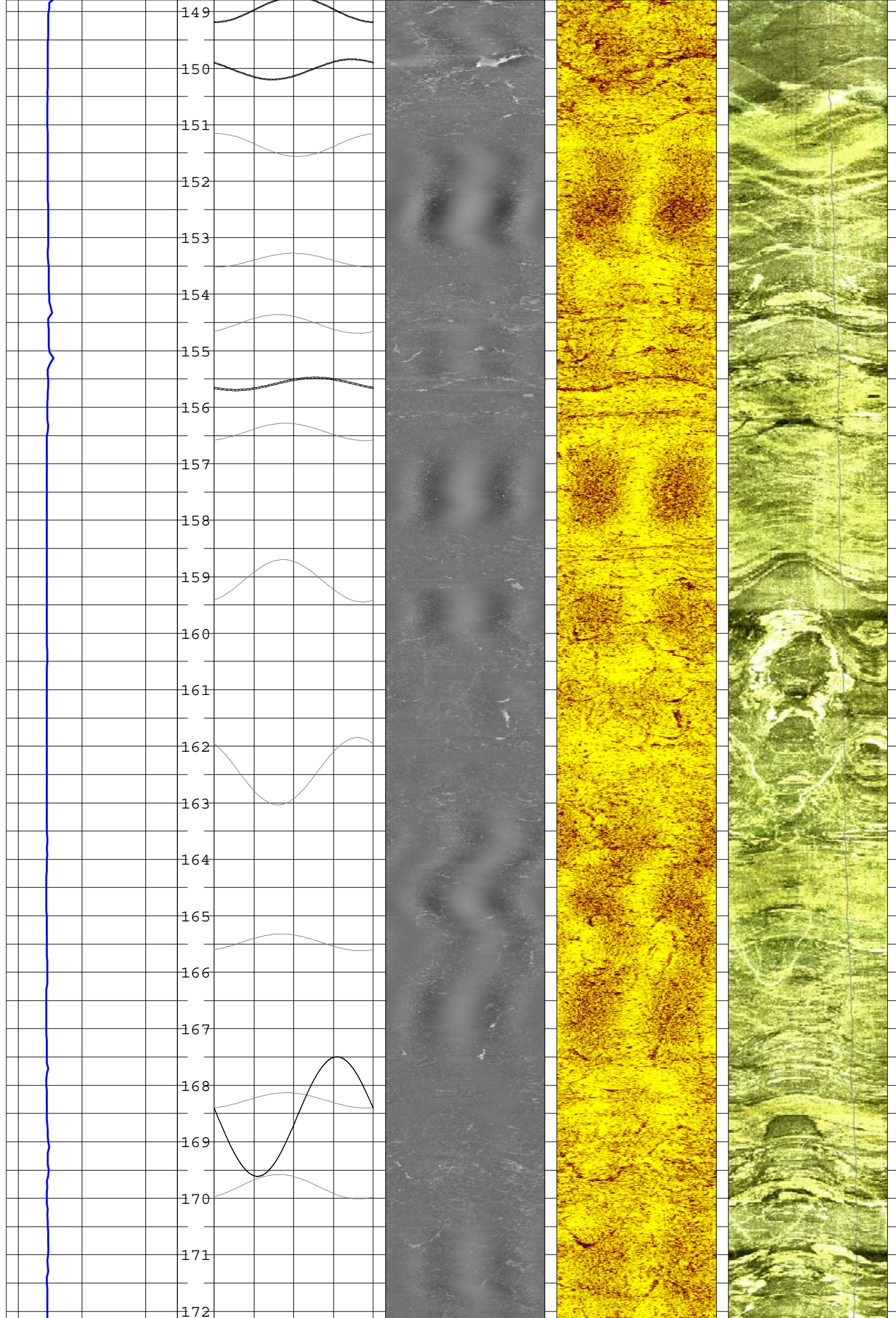


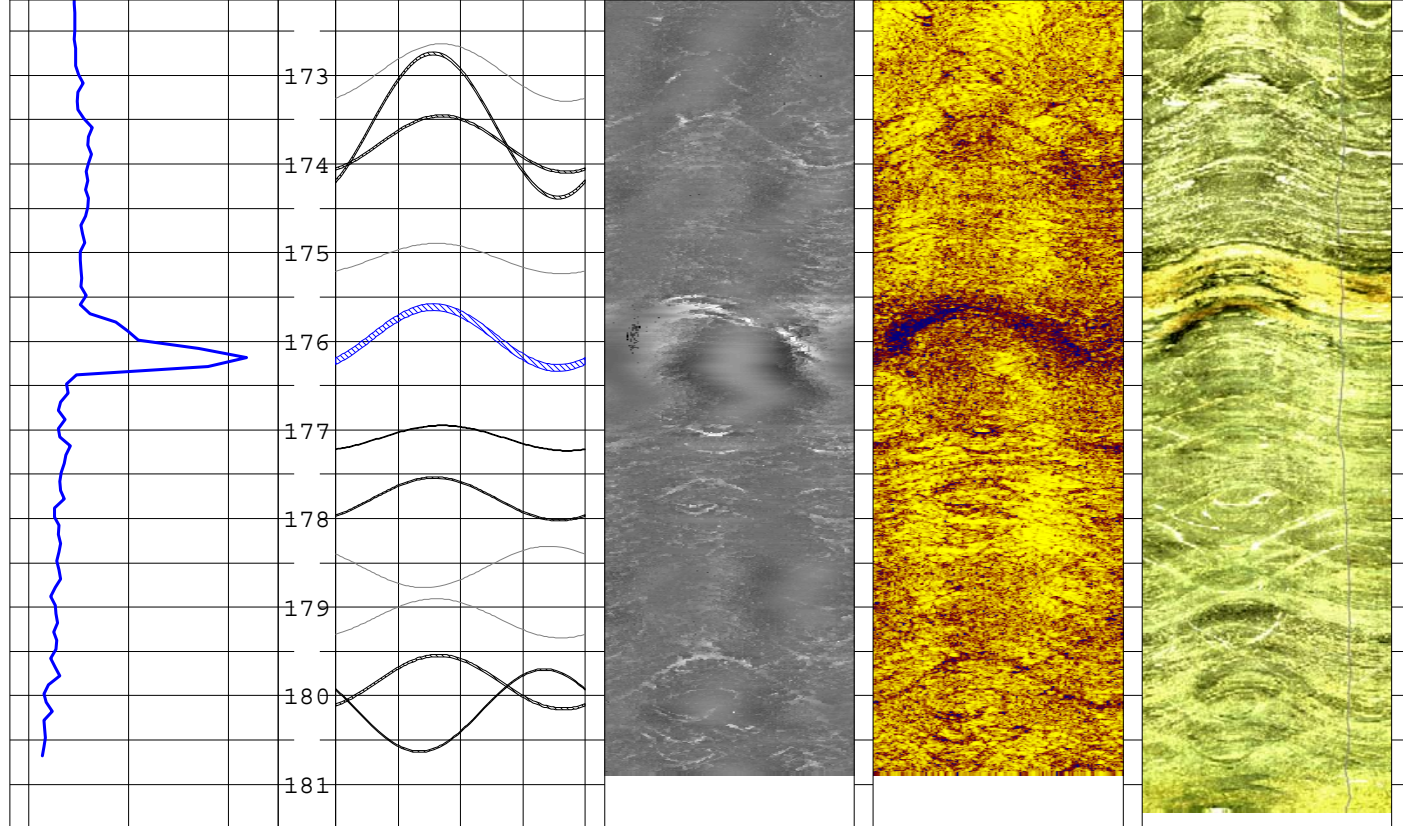












**TABLE A-1 Planar features interpreted from acoustical and optical televiewers****OC-BB-1-2018- Olin Site - Wilmington, MA****March, 2018**

Declination: 14.6 degrees west

Borehole	Feature # Number	Feature depth Feet	Dip Degrees	Dip Azimuth magnetic	Strike magnetic	Dip Azimuth True	Strike True	Aperture mm	Category Type
OC-BB-1-2018	1	42.2	75	53	323	39	309	1	101
OC-BB-1-2018	2	43.2	26	323	233	308	218	<1 mm	100
OC-BB-1-2018	3	45.6	14	328	238	314	224	<1 mm	100
OC-BB-1-2018	4	46.0	15	347	257	333	243	<1 mm	100
OC-BB-1-2018	5	46.6	67	227	137	213	123	1	101
OC-BB-1-2018	6	46.9	39	307	217	292	202	<1 mm	100
OC-BB-1-2018	7	49.5	55	328	238	313	223	2	101
OC-BB-1-2018	8	50.7	17	303	213	289	199	5	101
OC-BB-1-2018	9	52.5	54	323	233	309	219	<1 mm	100
OC-BB-1-2018	10	53.5	27	332	242	317	227	<1 mm	100
OC-BB-1-2018	11	55.3	64	146	56	131	41	1	101
OC-BB-1-2018	12	55.9	30	325	235	310	220	<1 mm	100
OC-BB-1-2018	13	58.7	55	318	228	303	213	<1 mm	100
OC-BB-1-2018	14	60.6	24	301	211	286	196	<1 mm	100
OC-BB-1-2018	15	64.1	33	326	236	312	222	<1 mm	100
OC-BB-1-2018	16	67.1	7	188	98	174	84	4	101
OC-BB-1-2018	17	67.4	52	210	120	196	106	3	101
OC-BB-1-2018	18	68.1	8	42	312	27	297	3	101
OC-BB-1-2018	19	69.7	60	113	23	99	9	2	101
OC-BB-1-2018	20	71.0	77	63	333	49	319	4	101
OC-BB-1-2018	21	71.8	37	338	248	324	234	3	101
OC-BB-1-2018	22	72.4	80	59	329	44	314	2	101
OC-BB-1-2018	23	72.4	60	323	233	308	218	<1 mm	100
OC-BB-1-2018	24	73.5	55	322	232	307	217	<1 mm	100
OC-BB-1-2018	25	74.7	42	319	229	304	214	1	101
OC-BB-1-2018	26	75.9	78	70	340	56	326	2	101
OC-BB-1-2018	27	77.1	44	321	231	307	217	4	101
OC-BB-1-2018	28	80.6	59	318	228	304	214	2	101
OC-BB-1-2018	29	82.2	41	327	237	312	222	<1 mm	100
OC-BB-1-2018	30	84.1	41	313	223	298	208	<1 mm	100
OC-BB-1-2018	31	86.5	76	78	348	64	334	2	101
OC-BB-1-2018	32	86.8	46	302	212	288	198	<1 mm	100
OC-BB-1-2018	33	87.1	78	75	345	61	331	1	101
OC-BB-1-2018	34	88.7	79	323	233	308	218	2	101
OC-BB-1-2018	35	91.7	54	146	56	131	41	<1 mm	100
OC-BB-1-2018	36	92.9	67	139	49	125	35	3	101
OC-BB-1-2018	37	93.9	69	140	50	125	35	2	101
OC-BB-1-2018	38	94.1	52	328	238	314	224	<1 mm	100
OC-BB-1-2018	39	95.1	63	138	48	124	34	1	101
OC-BB-1-2018	40	95.9	84	314	224	300	210	1	101
OC-BB-1-2018	41	96.1	75	133	43	118	28	1	101
OC-BB-1-2018	42	96.1	77	62	332	47	317	1	101
OC-BB-1-2018	43	96.5	84	321	231	306	216	1	101
OC-BB-1-2018	44	98.4	63	322	232	307	217	<1 mm	100
OC-BB-1-2018	45	99.3	83	322	232	308	218	1	101
OC-BB-1-2018	46	101.0	25	348	258	334	244	<1 mm	100
OC-BB-1-2018	47	104.5	65	331	241	316	226	<1 mm	100
OC-BB-1-2018	48	104.9	72	330	240	315	225	2	108
OC-BB-1-2018	49	106.3	72	321	231	306	216	2	108
OC-BB-1-2018	50	107.7	57	329	239	315	225	<1 mm	100
OC-BB-1-2018	51	110.2	84	210	120	196	106	1	101
OC-BB-1-2018	52	110.2	58	324	234	309	219	<1 mm	100
OC-BB-1-2018	53	111.3	70	127	37	112	22	1	101
OC-BB-1-2018	54	111.5	62	316	226	301	211	<1 mm	100
OC-BB-1-2018	55	113.1	77	37	307	22	292	2	101
OC-BB-1-2018	56	114.6	78	58	328	43	313	1	101
OC-BB-1-2018	57	114.7	86	219	129	204	114	3	108
OC-BB-1-2018	58	115.0	60	318	228	304	214	1	101
OC-BB-1-2018	59	115.2	78	313	223	299	209	<1 mm	100
OC-BB-1-2018	60	116.6	76	322	232	307	217	4	108
OC-BB-1-2018	61	116.7	84	323	233	308	218	1	101

**TABLE A-1 Planar features interpreted from acoustical and optical televewers**  
**OC-BB-1-2018- Olin Site - Wilmington, MA**

**March, 2018**

Declination: 14.6 degrees west

Borehole	Feature # Number	Feature depth Feet	Dip Degrees	Dip Azimuth magnetic	Strike magnetic	Dip Azimuth True	Strike True	Aperture mm	Category Type
OC-BB-1-2018	62	116.9	76	57	327	42	312	2	101
OC-BB-1-2018	63	118.2	28	29	299	14	284	5	101
OC-BB-1-2018	64	119.8	65	320	230	306	216	<1 mm	100
OC-BB-1-2018	65	120.5	51	140	50	125	35	2	101
OC-BB-1-2018	66	121.3	69	316	226	301	211	<1 mm	100
OC-BB-1-2018	67	121.3	78	137	47	122	32	1	101
OC-BB-1-2018	68	124.0	71	62	332	47	317	3	101
OC-BB-1-2018	69	124.9	49	301	211	287	197	<1 mm	100
OC-BB-1-2018	70	128.2	72	69	339	54	324	2	101
OC-BB-1-2018	71	128.5	65	331	241	316	226	<1 mm	100
OC-BB-1-2018	72	129.0	35	114	24	100	10	2	101
OC-BB-1-2018	73	130.3	68	332	242	318	228	<1 mm	100
OC-BB-1-2018	74	131.0	75	327	237	312	222	2	101
OC-BB-1-2018	75	132.2	74	78	348	63	333	2	101
OC-BB-1-2018	76	135.2	63	322	232	308	218	2	101
OC-BB-1-2018	77	136.8	66	328	238	313	223	<1 mm	100
OC-BB-1-2018	78	137.8	46	307	217	293	203	<1 mm	100
OC-BB-1-2018	79	140.7	64	149	59	135	45	<1 mm	100
OC-BB-1-2018	80	142.5	51	317	227	303	213	<1 mm	100
OC-BB-1-2018	81	145.0	49	142	52	128	38	<1 mm	100
OC-BB-1-2018	82	146.6	33	339	249	324	234	<1 mm	100
OC-BB-1-2018	83	147.2	66	129	39	115	25	7	101
OC-BB-1-2018	84	148.2	57	137	47	122	32	<1 mm	100
OC-BB-1-2018	85	149.0	56	2	272	348	258	2	101
OC-BB-1-2018	86	150.0	50	132	42	117	27	4	101
OC-BB-1-2018	87	151.4	53	188	98	173	83	<1 mm	100
OC-BB-1-2018	88	153.4	40	359	269	344	254	<1 mm	100
OC-BB-1-2018	89	154.5	48	325	235	310	220	<1 mm	100
OC-BB-1-2018	90	155.6	36	49	319	34	304	5	101
OC-BB-1-2018	91	156.4	46	342	252	327	237	<1 mm	100
OC-BB-1-2018	92	159.1	68	336	246	321	231	<1 mm	100
OC-BB-1-2018	93	162.5	76	145	55	130	40	<1 mm	100
OC-BB-1-2018	94	165.5	45	332	242	318	228	<1 mm	100
OC-BB-1-2018	95	168.3	42	344	254	329	239	<1 mm	100
OC-BB-1-2018	96	168.6	82	98	8	84	354	0	101
OC-BB-1-2018	97	169.8	55	327	237	312	222	<1 mm	100
OC-BB-1-2018	98	173.0	65	332	242	318	228	<1 mm	100
OC-BB-1-2018	99	173.6	79	321	231	306	216	2	101
OC-BB-1-2018	100	173.8	65	333	243	318	228	3	101
OC-BB-1-2018	101	175.1	49	325	235	311	221	<1 mm	100
OC-BB-1-2018	102	176.0	66	321	231	306	216	10	107
OC-BB-1-2018	103	177.1	44	334	244	319	229	3	101
OC-BB-1-2018	104	177.8	58	322	232	308	218	3	101
OC-BB-1-2018	105	178.6	58	128	38	113	23	<1 mm	100
OC-BB-1-2018	106	179.1	56	325	235	310	220	<1 mm	100
OC-BB-1-2018	107	179.9	64	328	238	314	224	3	101
OC-BB-1-2018	108	180.2	72	121	31	106	16	1	101

**Explanation:**

Category 100 = planar feature (possible foliation, bedding, or fracture aperture < 1 mm)

Category 101 = planar feature (possible fracture, joint, crack, etc. aperture > 1 mm)

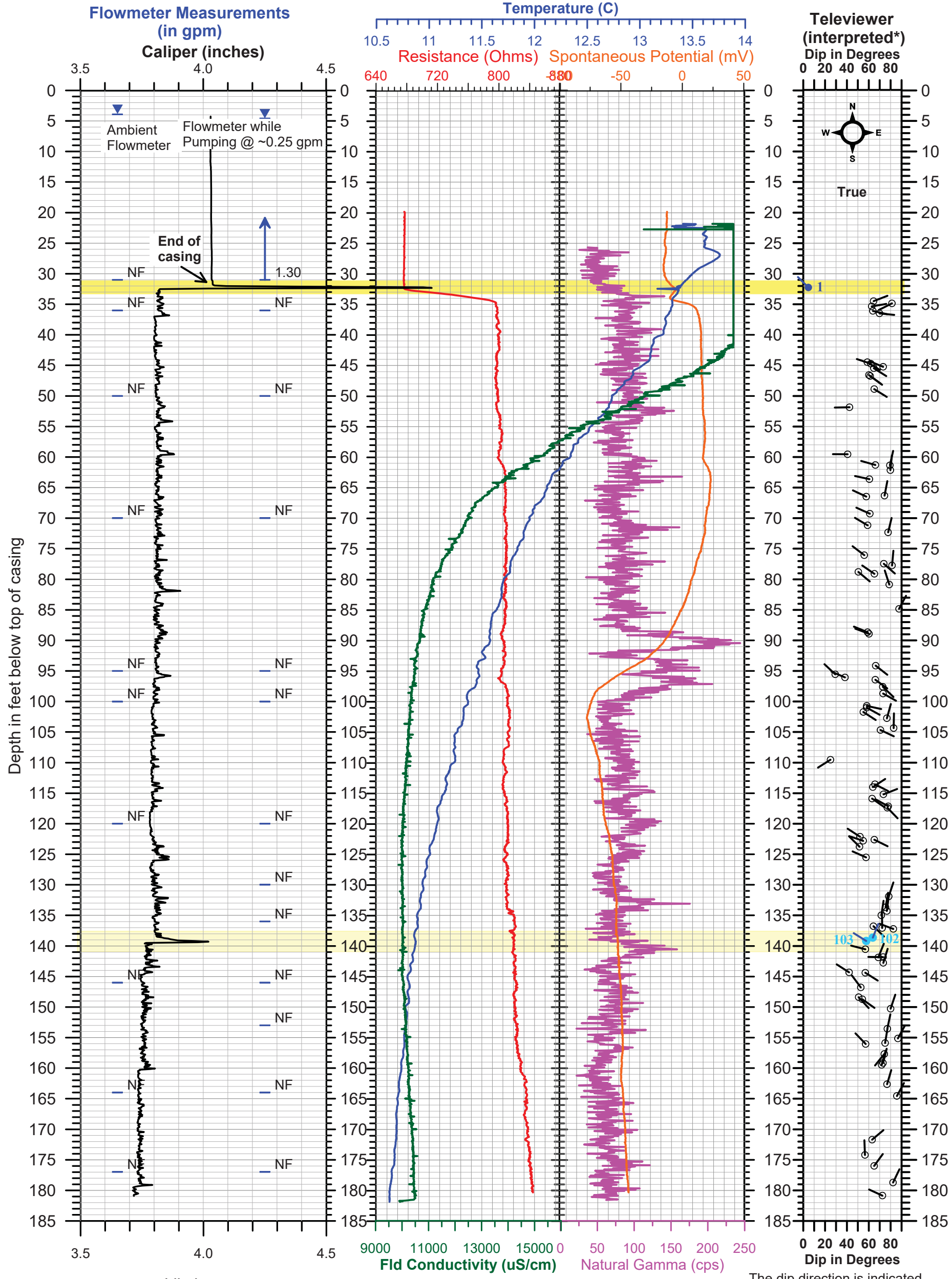
Category 108 = Possible water bearing fracture

Category 107 = Likely water bearing feature

**ATTACHMENT 2B**  
**BOREHOLE GEOPHYSICAL LOGS**  
**OC-BB-2-2018**

PLATE B-1  
Borehole Geophysical Log  
OC-BB-2-2018  
Olin Site  
Wilmington, MA.

Date logged: 3/23/18

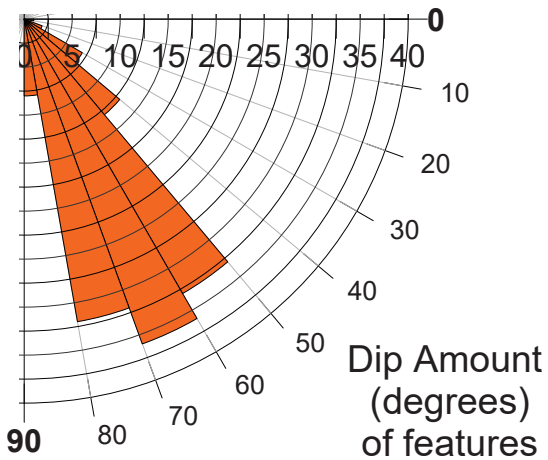
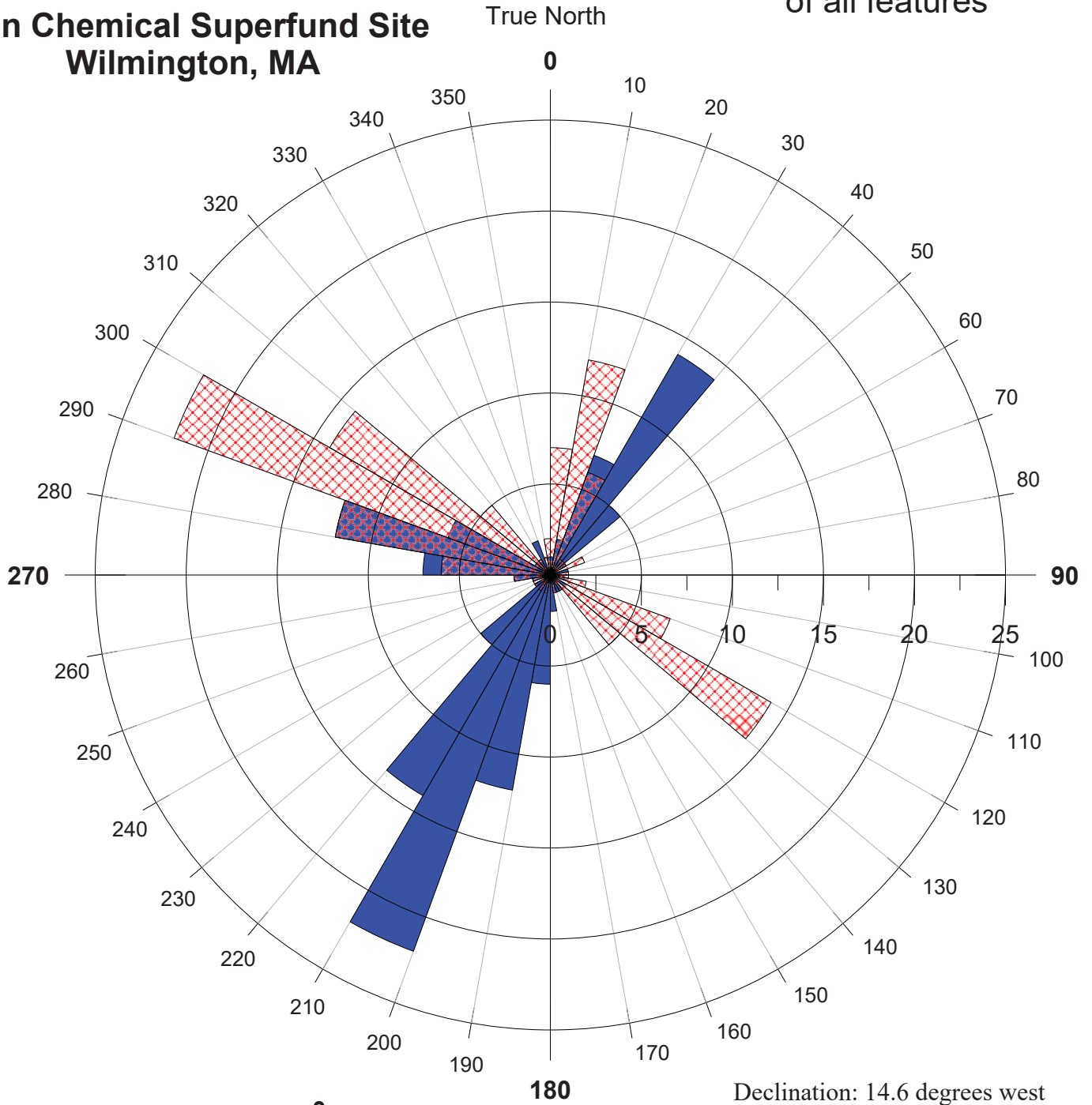


= Likely transmissive zone  
 = possible transmissive zone

The dip direction is indicated by the line extending from the circle. The strike of the feature is 90 degrees from this.

**OC-BB-2-2018**  
**Olin Chemical Superfund Site**  
**Wilmington, MA**

**PLATE B-2**  
**Strike and Dip Direction**  
**of all features**

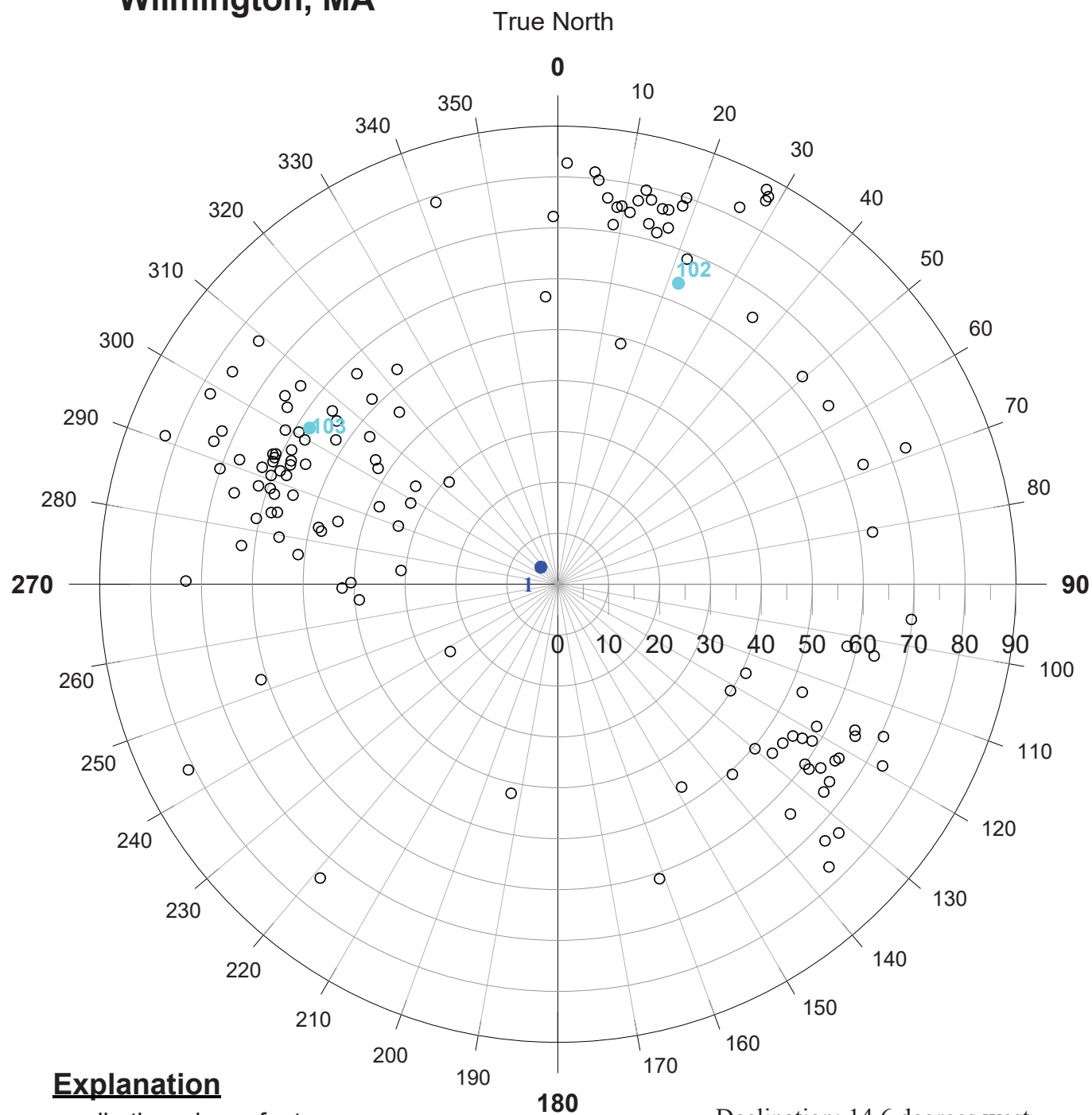


- Explanation
- Dip direction of feature
  - Strike of feature
  - Dip Amount (Tilt)

Based on 132 measurements

**OC-BB-2-2018**  
**Olin Chemical Superfund Site**  
**Wilmington, MA**

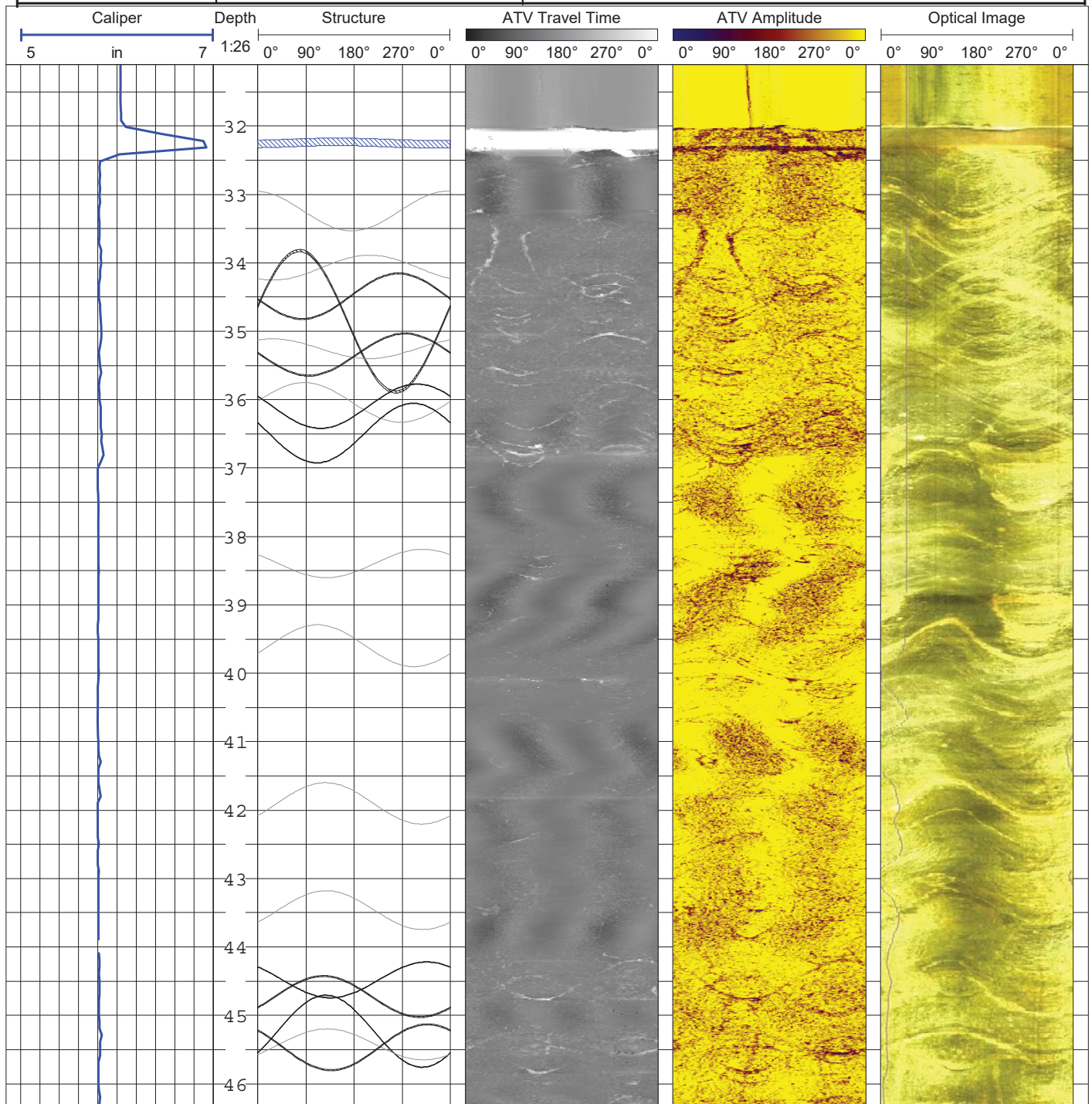
**PLATE B-3**  
**Dip Amount and Dip Azimuth**  
**of planar features**  
**(upper hemisphere plot)**

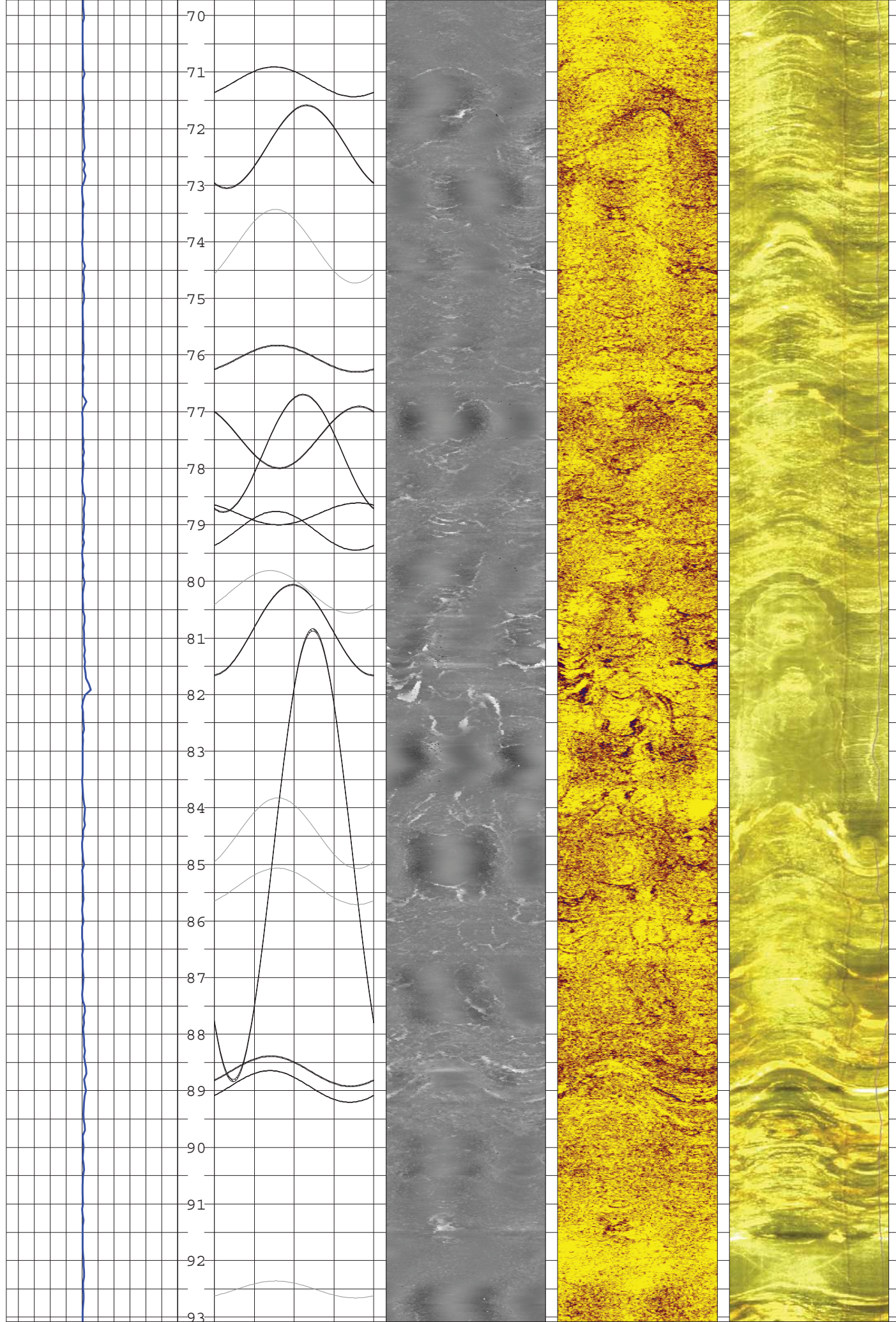


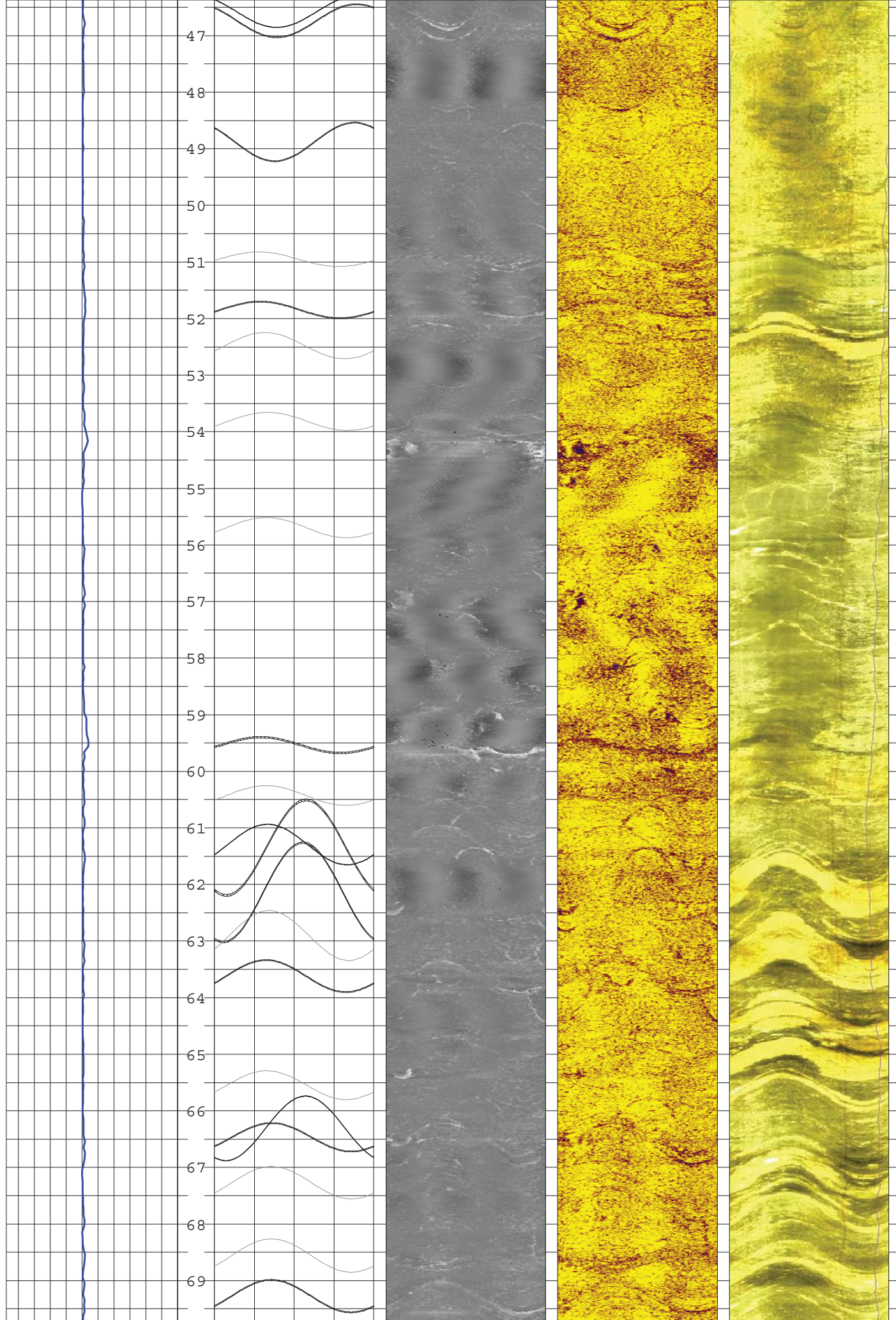
**Explanation**

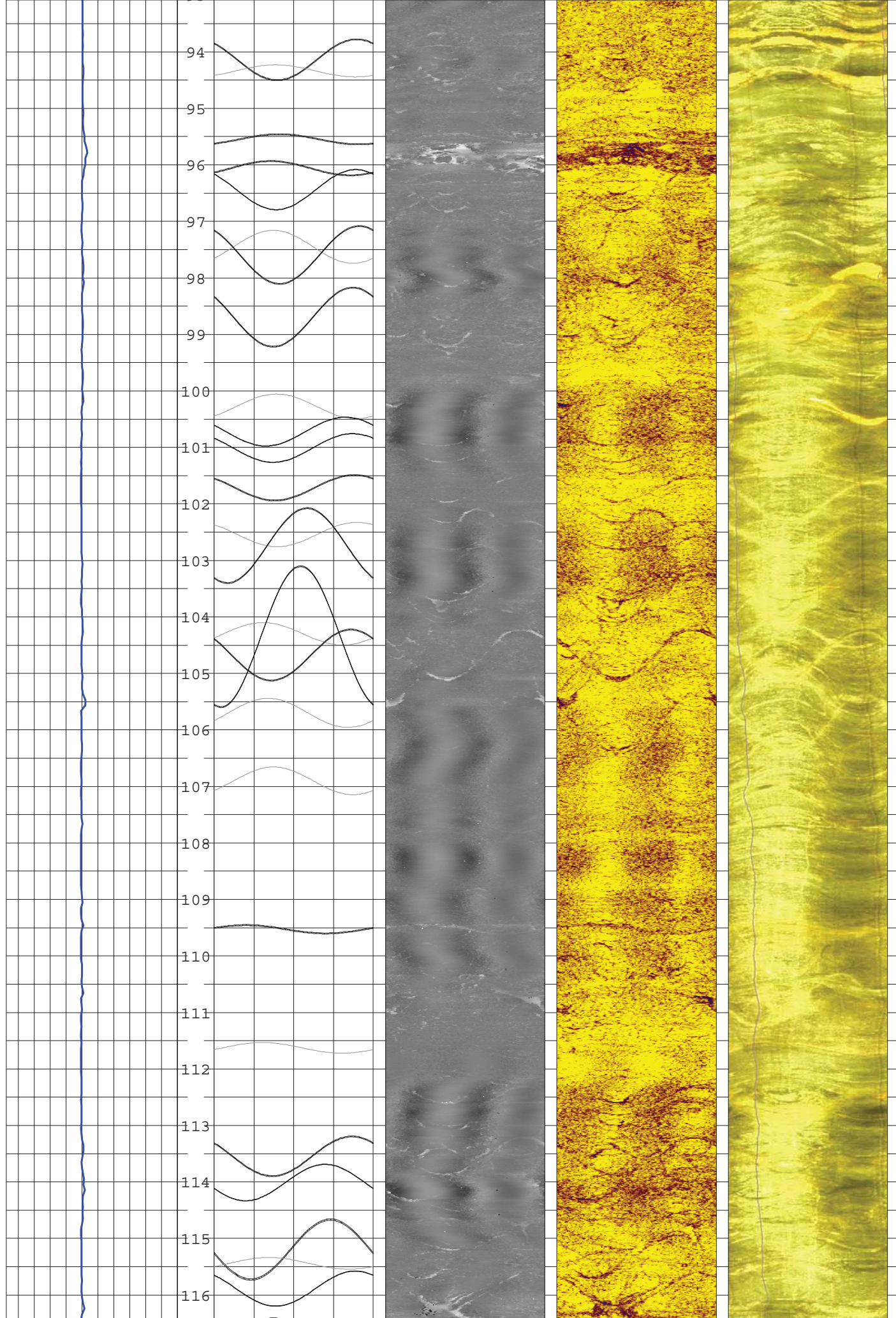
- all other planar features
- Likely water bearing
- Possibly water bearing

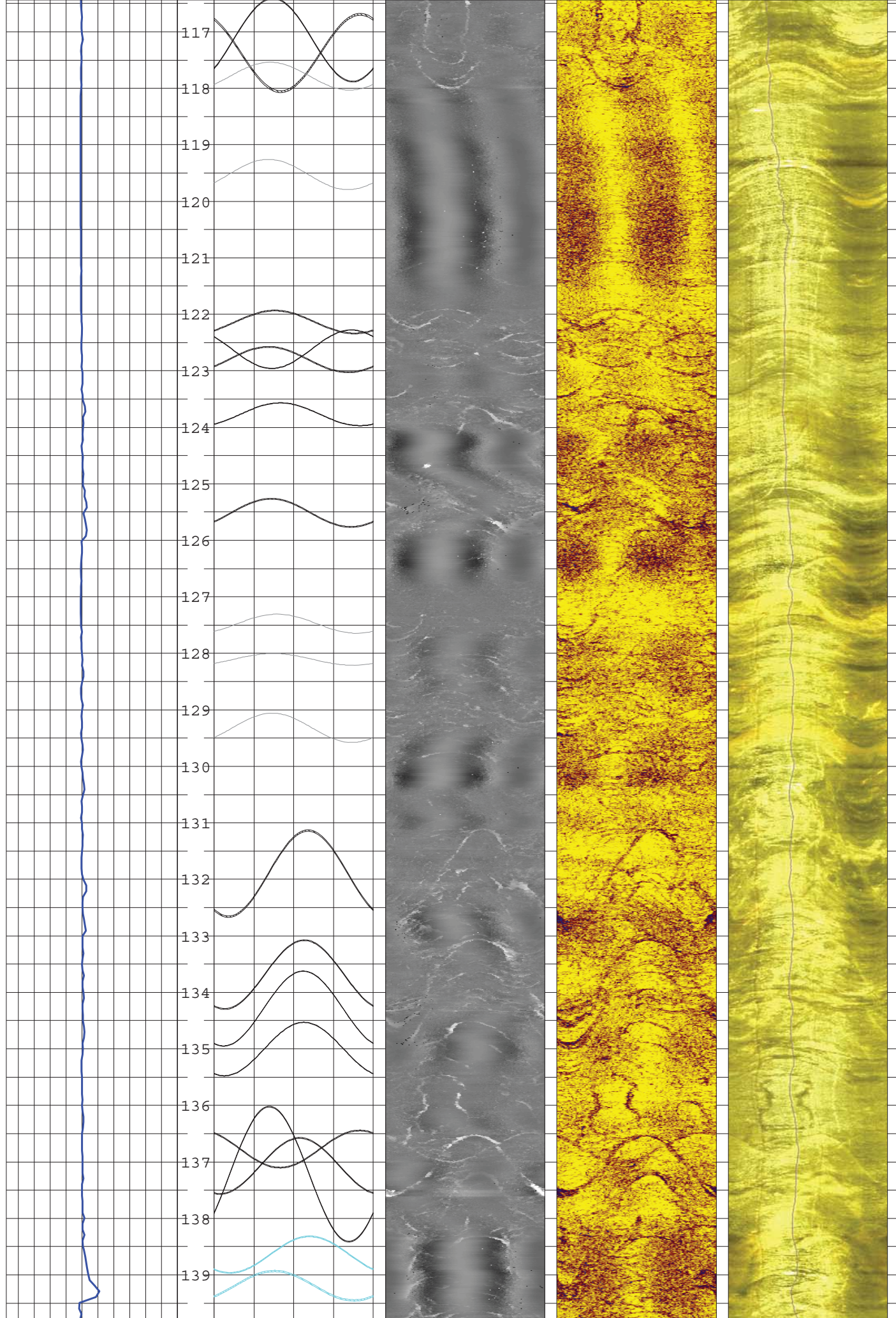
<b>Northeast Geophysical Services</b> 4 Union Street Bangor, Maine 04401 Tel. 207-942-2700 email: ngsinc@negeophysical.com		<b>Log: Plate B-4 Televiwer &amp; Caliper Logs</b>	
		Well: OC-BB-2-2018	
		Site: Olin	
Date:	3/23/2018	Location: Wilmington, MA	
Casing Depth:	32 ft	For:	Wood
Casing Type:	4 in steel	Logged by:	R. Rawcliffe
Boring Depth:	182.1 ft.	Orientation:	magnetic
Meas. From:	top of casing	<b>Structure Plots:</b> black = planar features (faults, foliation, bedding, joints, etc) light blue = possibly transmissive fracture dark blue = likely transmissive fracture	
<b>Stickup:</b>	1.6 ft.		
<b>Water Level:</b>	3.92 ft.		

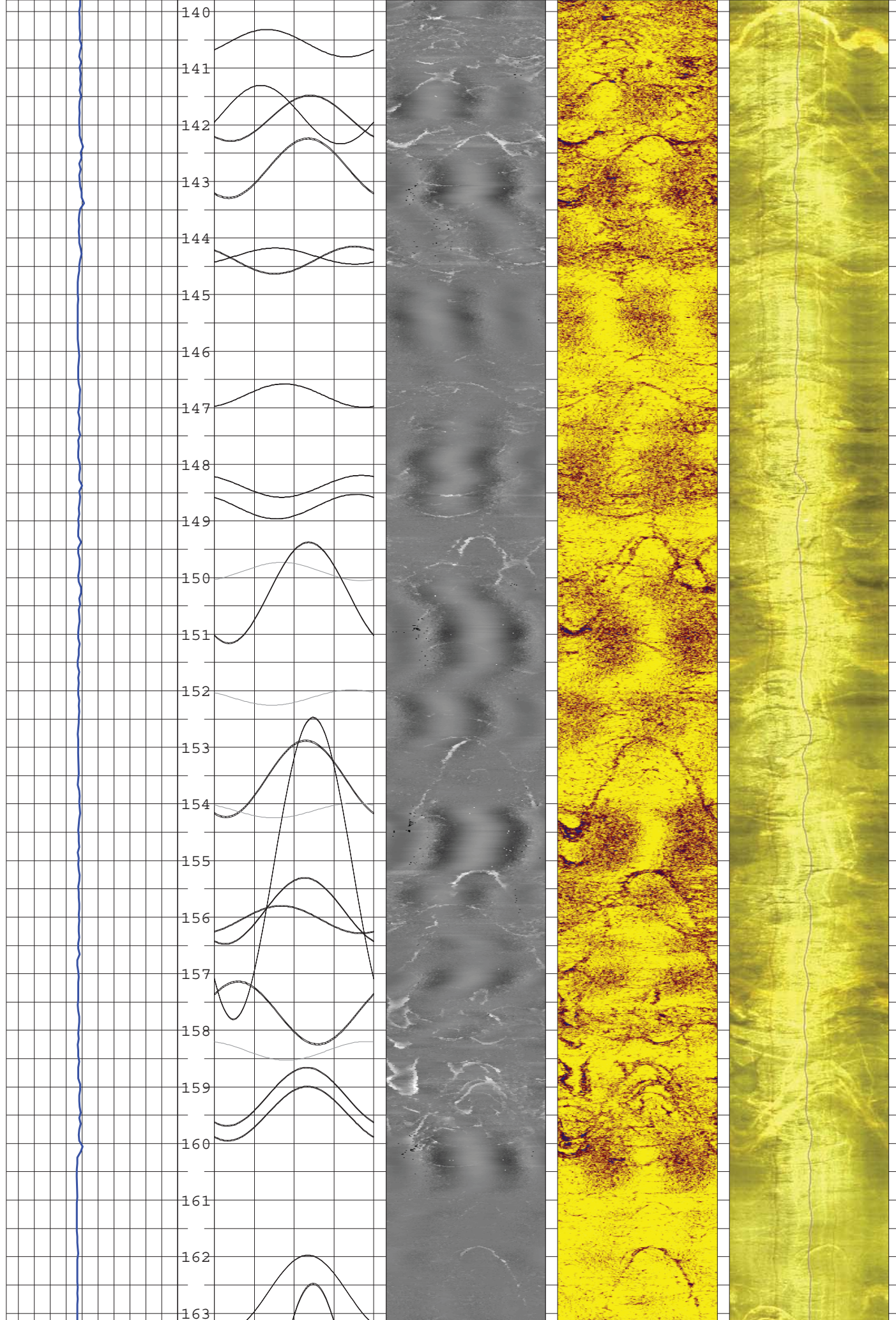


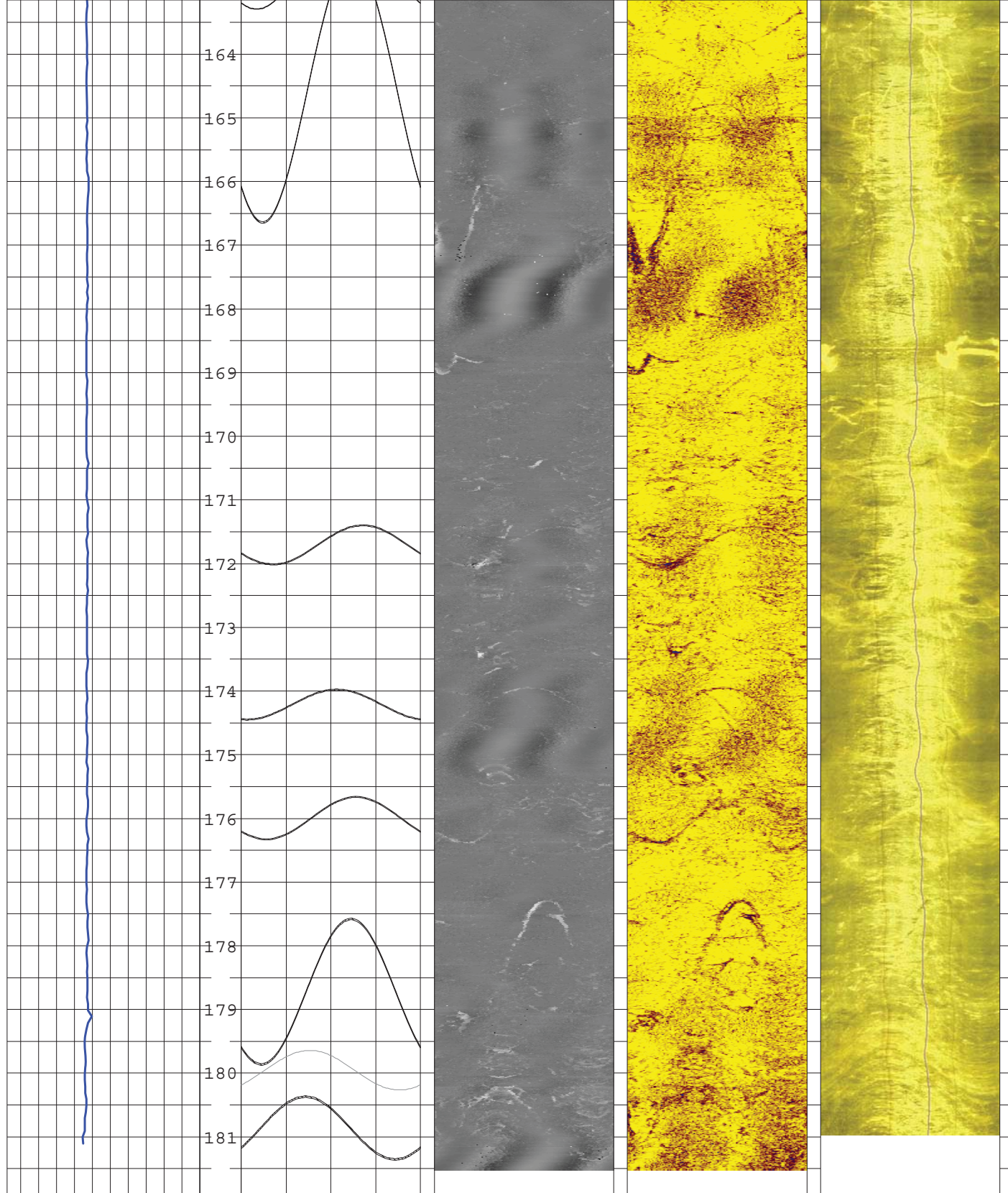












**TABLE B-1 Planar features interpreted from acoustical and optical televiewers**  
**OC-BB-2-2018- Olin Site - Wilmington, MA**

**March, 2018**

Declination: 14.6 degrees west

Borehole	Feature # Number	Feature depth Feet	Dip Degrees	Dip Azimuth magnetic	Strike magnetic	Dip Azimuth True	Strike True	Aperture mm	Category Type
OC-BB-2-2018	1	32.3	5	330	240	315	225	34	107
OC-BB-2-2018	2	33.2	61	176	86	161	71	<1 mm	100
OC-BB-2-2018	3	34.1	49	29	299	15	285	<1 mm	100
OC-BB-2-2018	4	34.5	64	83	353	69	339	2	101
OC-BB-2-2018	5	34.9	81	258	168	243	153	2	101
OC-BB-2-2018	6	35.3	42	207	117	193	103	<1 mm	100
OC-BB-2-2018	7	35.3	63	95	5	81	351	2	101
OC-BB-2-2018	8	36.0	61	267	177	252	162	<1 mm	100
OC-BB-2-2018	9	36.1	64	117	27	103	13	1	101
OC-BB-2-2018	10	36.5	70	110	20	96	6	1	101
OC-BB-2-2018	11	38.4	53	128	38	114	24	<1 mm	100
OC-BB-2-2018	12	39.6	63	292	202	277	187	<1 mm	100
OC-BB-2-2018	13	41.9	62	306	216	292	202	<1 mm	100
OC-BB-2-2018	14	43.5	61	308	218	293	203	<1 mm	100
OC-BB-2-2018	15	44.5	59	136	46	122	32	1	101
OC-BB-2-2018	16	44.7	62	303	213	288	198	3	101
OC-BB-2-2018	17	45.2	73	307	217	293	203	1	101
OC-BB-2-2018	18	45.4	55	310	220	295	205	<1 mm	100
OC-BB-2-2018	19	45.5	65	137	47	122	32	2	101
OC-BB-2-2018	20	46.6	60	141	51	126	36	2	101
OC-BB-2-2018	21	46.7	61	141	51	126	36	2	101
OC-BB-2-2018	22	48.9	65	136	46	122	32	2	101
OC-BB-2-2018	23	51.0	39	280	190	265	175	<1 mm	100
OC-BB-2-2018	24	51.9	42	284	194	269	179	3	101
OC-BB-2-2018	25	52.5	56	294	204	280	190	<1 mm	100
OC-BB-2-2018	26	53.8	45	301	211	286	196	<1 mm	100
OC-BB-2-2018	27	55.7	48	298	208	283	193	<1 mm	100
OC-BB-2-2018	28	59.5	41	285	195	270	180	6	101
OC-BB-2-2018	29	60.4	48	297	207	283	193	<1 mm	100
OC-BB-2-2018	30	61.3	66	300	210	286	196	2	101
OC-BB-2-2018	31	61.4	79	27	297	13	283	2	101
OC-BB-2-2018	32	62.1	80	20	290	6	276	2	101
OC-BB-2-2018	33	62.9	70	303	213	289	199	<1 mm	100
OC-BB-2-2018	34	63.6	61	297	207	282	192	2	101
OC-BB-2-2018	35	65.6	58	299	209	284	194	<1 mm	100
OC-BB-2-2018	36	66.3	74	26	296	11	281	1	101
OC-BB-2-2018	37	66.5	58	309	219	295	205	3	101
OC-BB-2-2018	38	67.3	61	309	219	295	205	<1 mm	100
OC-BB-2-2018	39	68.6	62	309	219	295	205	<1 mm	100
OC-BB-2-2018	40	69.3	61	309	219	294	204	2	101
OC-BB-2-2018	41	71.2	59	315	225	300	210	2	101
OC-BB-2-2018	42	72.3	78	28	298	14	284	1	101
OC-BB-2-2018	43	74.1	76	318	228	303	213	<1 mm	100
OC-BB-2-2018	44	76.1	56	322	232	308	218	2	101
OC-BB-2-2018	45	77.5	74	146	56	132	42	1	101
OC-BB-2-2018	46	77.7	81	20	290	5	275	1	101
OC-BB-2-2018	47	78.8	50	144	54	130	40	2	101
OC-BB-2-2018	48	79.1	65	319	229	305	215	2	101
OC-BB-2-2018	49	80.2	67	306	216	291	201	<1 mm	100
OC-BB-2-2018	50	80.9	79	357	267	342	252	1	101
OC-BB-2-2018	51	84.5	76	324	234	309	219	<1 mm	100
OC-BB-2-2018	52	84.8	88	42	312	28	298	0	101
OC-BB-2-2018	53	85.4	64	322	232	308	218	<1 mm	100
OC-BB-2-2018	54	88.7	59	307	217	292	202	2	101
OC-BB-2-2018	55	88.9	60	305	215	291	201	1	101
OC-BB-2-2018	56	92.5	43	319	229	304	214	<1 mm	100
OC-BB-2-2018	57	94.1	66	143	53	128	38	2	101
OC-BB-2-2018	58	94.3	34	319	229	305	215	<1 mm	100
OC-BB-2-2018	59	95.6	29	328	238	313	223	4	101
OC-BB-2-2018	60	96.1	38	308	218	293	203	6	101
OC-BB-2-2018	61	96.4	66	141	51	126	36	1	101
OC-BB-2-2018	62	97.5	61	314	224	299	209	<1 mm	100

**TABLE B-1 Planar features interpreted from acoustical and optical televiewers****OC-BB-2-2018- Olin Site - Wilmington, MA****March, 2018**

Declination: 14.6 degrees west

Borehole	Feature # Number	Feature depth Feet	Dip Degrees	Dip Azimuth magnetic	Strike magnetic	Dip Azimuth True	Strike True	Aperture mm	Category Type
OC-BB-2-2018	63	97.6	73	148	58	134	44	1	101
OC-BB-2-2018	64	98.7	73	134	44	119	29	1	101
OC-BB-2-2018	65	100.3	54	321	231	306	216	<1 mm	100
OC-BB-2-2018	66	100.7	58	117	27	102	12	1	101
OC-BB-2-2018	67	101.0	58	133	43	119	29	2	101
OC-BB-2-2018	68	101.7	55	137	47	123	33	3	101
OC-BB-2-2018	69	102.5	54	143	53	128	38	<1 mm	100
OC-BB-2-2018	70	102.7	77	30	300	16	286	1	101
OC-BB-2-2018	71	104.3	51	291	201	277	187	<1 mm	100
OC-BB-2-2018	72	104.4	83	16	286	1	271	1	101
OC-BB-2-2018	73	104.7	71	130	40	115	25	2	101
OC-BB-2-2018	74	105.7	58	302	212	288	198	<1 mm	100
OC-BB-2-2018	75	106.9	57	314	224	300	210	<1 mm	100
OC-BB-2-2018	76	109.5	25	252	162	238	148	4	101
OC-BB-2-2018	77	111.6	31	290	200	275	185	<1 mm	100
OC-BB-2-2018	78	113.6	66	132	42	117	27	1	101
OC-BB-2-2018	79	114.0	64	71	341	57	327	2	101
OC-BB-2-2018	80	115.2	73	83	353	69	339	2	101
OC-BB-2-2018	81	115.4	33	305	215	290	200	<1 mm	100
OC-BB-2-2018	82	115.9	63	140	50	125	35	1	101
OC-BB-2-2018	83	117.2	78	313	223	299	209	1	101
OC-BB-2-2018	84	117.4	77	151	61	136	46	2	101
OC-BB-2-2018	85	117.8	57	306	216	292	202	<1 mm	100
OC-BB-2-2018	86	119.5	60	303	213	288	198	<1 mm	100
OC-BB-2-2018	87	122.1	52	318	228	303	213	3	101
OC-BB-2-2018	88	122.6	65	131	41	116	26	1	101
OC-BB-2-2018	89	122.8	55	303	213	289	199	3	101
OC-BB-2-2018	90	123.8	52	330	240	315	225	2	101
OC-BB-2-2018	91	125.5	58	309	219	294	204	3	101
OC-BB-2-2018	92	127.5	47	323	233	308	218	<1 mm	100
OC-BB-2-2018	93	128.1	33	313	223	299	209	<1 mm	100
OC-BB-2-2018	94	129.3	59	311	221	297	207	<1 mm	100
OC-BB-2-2018	95	131.9	78	33	303	18	288	1	101
OC-BB-2-2018	96	133.7	75	24	294	10	280	1	101
OC-BB-2-2018	97	134.3	77	22	292	7	277	0	101
OC-BB-2-2018	98	135.0	71	23	293	9	279	1	101
OC-BB-2-2018	99	136.8	64	149	59	135	45	2	101
OC-BB-2-2018	100	137.1	72	14	284	359	269	1	101
OC-BB-2-2018	101	137.2	82	305	215	291	201	1	101
OC-BB-2-2018	102	138.6	64	36	306	22	292	2	108
OC-BB-2-2018	103	139.2	58	317	227	302	212	3	108
OC-BB-2-2018	104	140.6	57	299	209	284	194	1	101
OC-BB-2-2018	105	141.8	73	285	195	270	180	1	101
OC-BB-2-2018	106	141.9	69	36	306	22	292	2	101
OC-BB-2-2018	107	142.8	73	32	302	17	287	2	101
OC-BB-2-2018	108	144.3	42	317	227	303	213	3	101
OC-BB-2-2018	109	144.4	57	137	47	122	32	2	101
OC-BB-2-2018	110	146.8	53	338	248	323	233	1	101
OC-BB-2-2018	111	148.4	51	152	62	137	47	2	101
OC-BB-2-2018	112	148.7	54	140	50	125	35	2	101
OC-BB-2-2018	113	149.9	46	332	242	317	227	<1 mm	100
OC-BB-2-2018	114	150.3	80	33	303	18	288	1	101
OC-BB-2-2018	115	152.1	41	130	40	115	25	<1 mm	100
OC-BB-2-2018	116	153.6	77	26	296	12	282	2	101
OC-BB-2-2018	117	154.1	40	136	46	122	32	<1 mm	100
OC-BB-2-2018	118	155.1	87	43	313	29	299	0	101
OC-BB-2-2018	119	155.9	75	24	294	9	279	2	101
OC-BB-2-2018	120	156.1	57	331	241	316	226	2	101
OC-BB-2-2018	121	157.7	74	234	144	219	129	2	101
OC-BB-2-2018	122	158.4	47	163	73	149	59	<1 mm	100
OC-BB-2-2018	123	159.2	73	29	299	14	284	2	101
OC-BB-2-2018	124	159.5	72	30	300	16	286	2	101

**TABLE B-1 Planar features interpreted from acoustical and optical televiewers**  
**OC-BB-2-2018- Olin Site - Wilmington, MA**

**March, 2018**

Declination: 14.6 degrees west

Borehole	Feature # Number	Feature depth Feet	Dip Degrees	Dip Azimuth magnetic	Strike magnetic	Dip Azimuth True	Strike True	Aperture mm	Category Type
OC-BB-2-2018	125	162.6	77	31	301	17	287	1	101
OC-BB-2-2018	126	164.6	86	43	313	28	298	1	101
OC-BB-2-2018	127	171.7	63	64	334	50	320	2	101
OC-BB-2-2018	128	174.2	57	12	282	358	268	3	101
OC-BB-2-2018	129	176.0	65	51	321	36	306	2	101
OC-BB-2-2018	130	178.7	82	40	310	26	296	1	101
OC-BB-2-2018	131	180.0	63	318	228	303	213	<1 mm	100
OC-BB-2-2018	132	180.9	72	309	219	295	205	2	101